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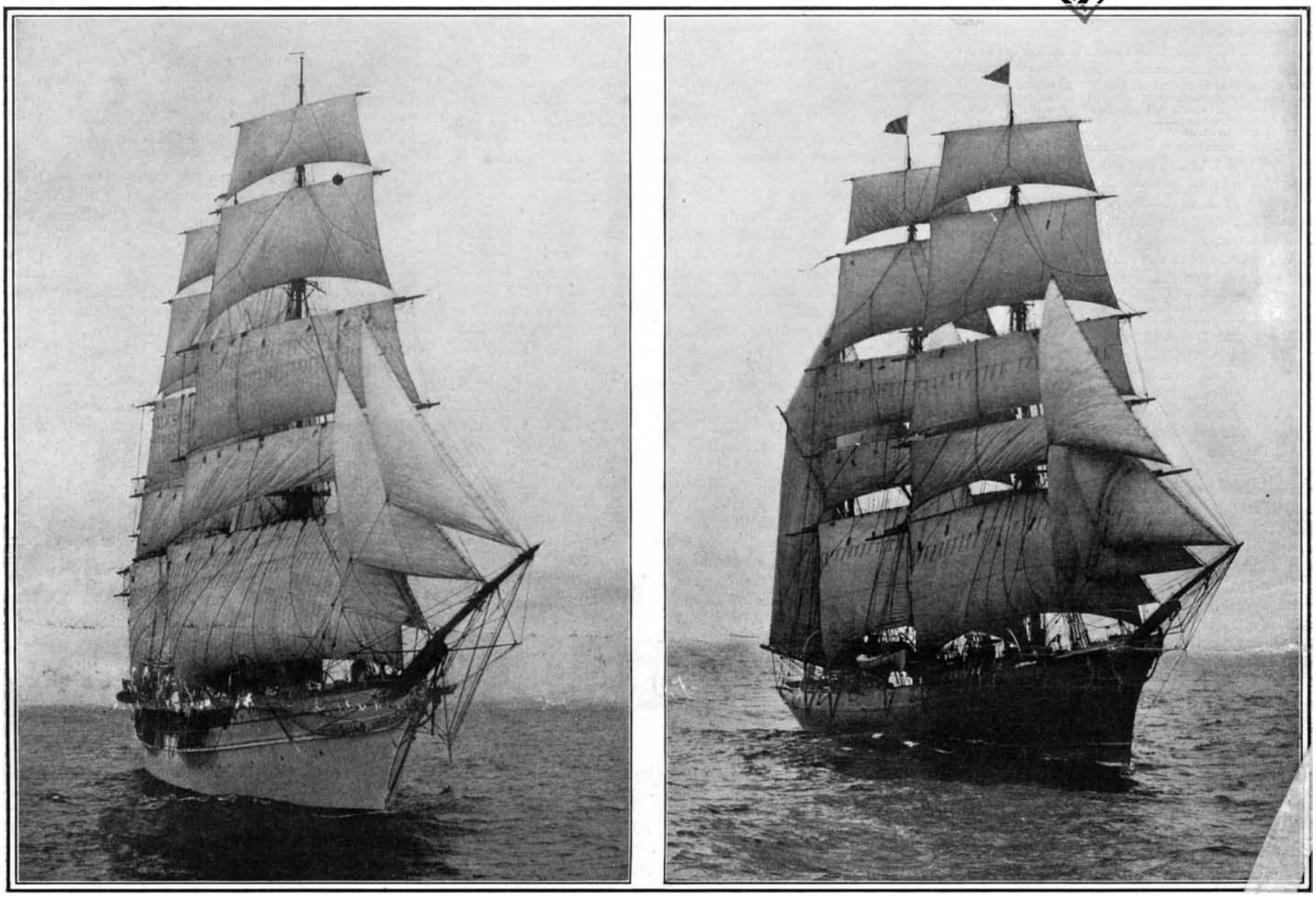

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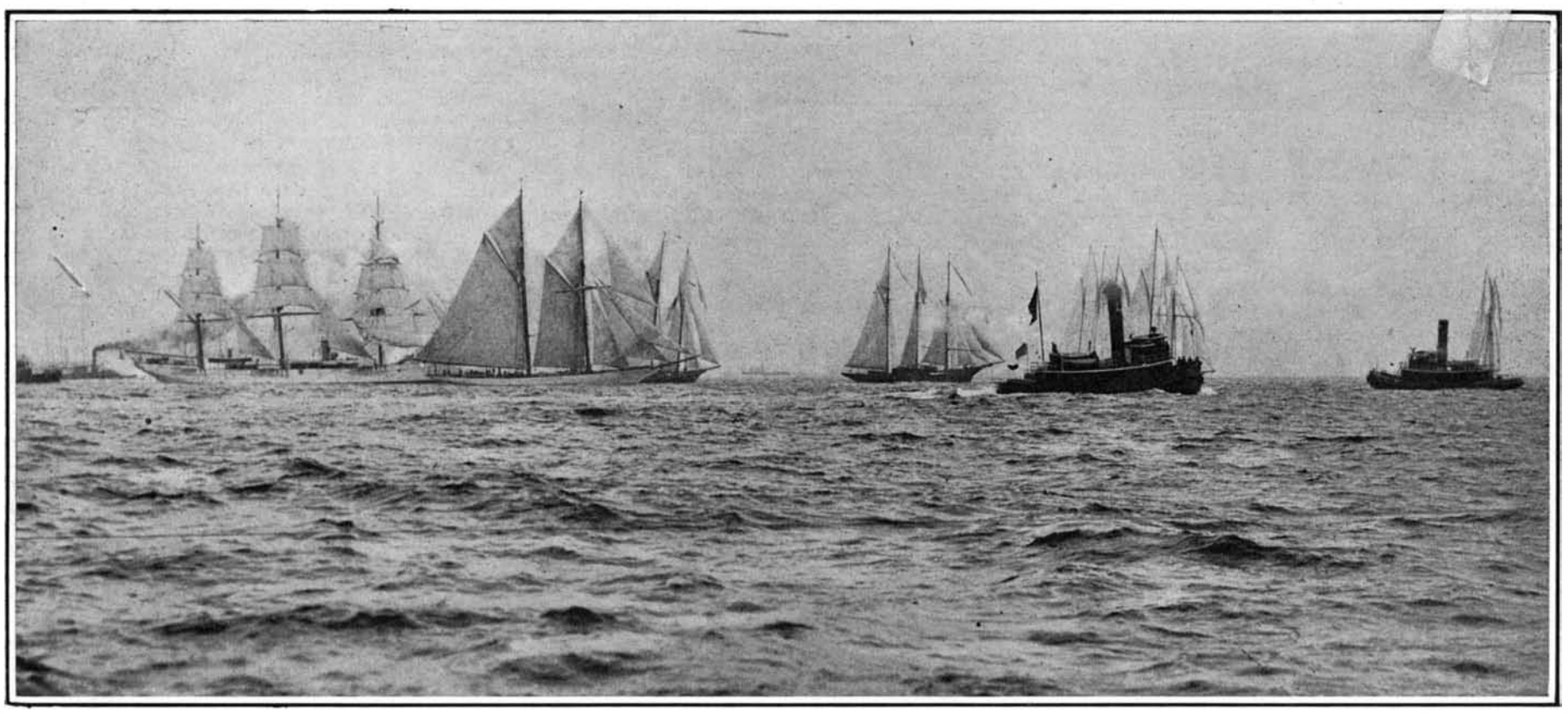
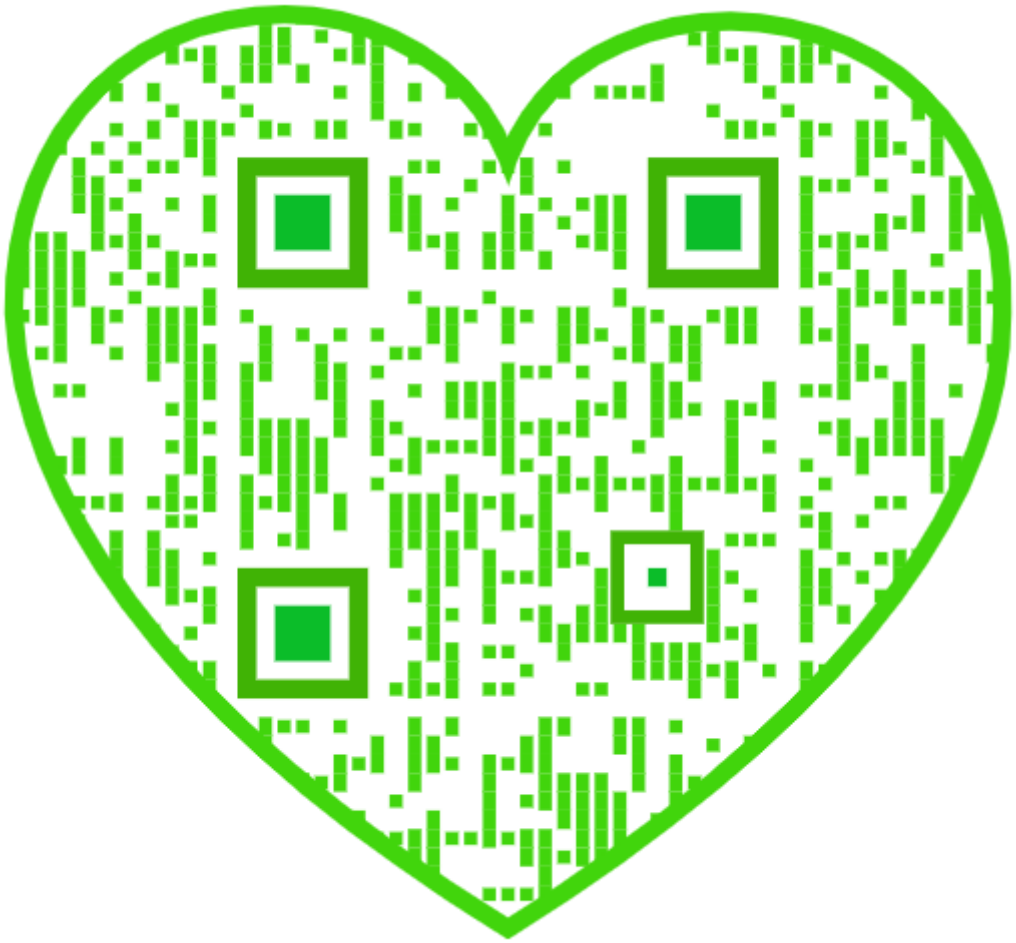
Two of the Square-Rigged Ships on the Port Tack Shortly After the Start.



"Valhalla." "Endymion." "Thistle." "Utowana." "Atlantic." "Ailsa." "Hamburg." "Hildegarde."

THE START OF THE 3,000-MILE OCEAN CUP RACE.—[See page 422.]



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NEW YORK, SATURDAY, MAY 27, 1905.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

HIGH EXPLOSIVES ON FREIGHT TRAINS.

In speaking of the recent tragedy on the lines of the company near Harrisburg, the Superintendent of Passenger Transportation of the Pennsylvania Railroad is reported to have said: "It was an accident which could not have been avoided. Every precaution known in train operation was in effect, and so far as I can see, there was not a single violation." It is probable that this official, speaking as an employe responsible for the observance of the rules of this company, was strictly within the facts; but the traveling public is surely justified in asking whether the rules for the acceptance, loading, and carriage of high explosives have been drawn with as strict an eye for the safety of the public as they have for the convenience of the railroads. We understand that dynamite and other high explosives are considered as ordinary freight, and that as far as any special precautions are concerned, it is loaded into cars in common with other boxed freight, the only difference being that the car containing it is usually labeled "High Explosives." Now, that such a condition of things is full of peril is proved by the fact that disastrous explosions resulting from the carriage of high explosives are not by any means infrequent. It is only when such deadly freight, as in the present case, becomes the cause of an explosion that results in a disastrous loss of life, that the attention of the public is forcibly drawn to this very serious peril. It is to be hoped that the legislation which is certain to be introduced with a view to rendering the transportation of high explosives more secure, will with better success than the recent attempt of Senator Elkins, chairman of the Interstate Commerce Commission, to put through a bill placing the regulation of this matter in the hands of the Commission. The mere tacking of an insignificant label upon a freight car that contains high explosive is surely a very inadequate means of warning and safeguard. A more sensible method would be for the railroads to reserve special cars for such freight, and give them a broadly distinctive color or a badge that would at once distinguish them from the cars for ordinary freight. The railroads, of course, would argue that such cars would be running for a large part of the time with but a fraction of a full load. But that could be compensated by charging a rate sufficiently high to meet the extra cost and inconvenience involved.

AN OFT-REPEATED QUESTION.

One of the questions from correspondents that comes to this office with persistent reiteration, is that of the possibility of one or other of the pair of wheels on a railroad axle, in passing around the curve, slipping on the rail over which it is rolling, while the other wheel does not slip on its rail. Although we have frequently explained how this condition is possible, the question is one that evidently continues to puzzle a great many people—in which respect it is first cousin to that other much-debated fact, that the portion of the periphery of a rolling cartwheel that is near the ground is moving more slowly with relation to the earth than is the rest of the periphery. In the case of the two wheels on any axle of a railroad or trolley car that is passing around a curve, it is evident that in a given length, say 100 feet of the curve, measured on a line lying centrally between the two rails, the inner rail will be shorter than the outer rail, and this for the reason that it is struck to a radius that is about 4¾ feet shorter. Now, when a pair of wheels passes around the curve, it follows that, because of the difference in length of the two rails, either the inner wheel must slip backward on the inner rail, or the outer wheel must slip forward on the outer rail; for the two wheels being fixed on the same axle, move at the same peripheral speed over different lengths of rail in the same time.

It is probable that the excessive wear of rails on curves is due chiefly to this slipping of the wheels. Not long ago some remarkable facts on rail wear on curves were brought out in the course of a paper read before the New England Street Railway Club by the Roadmaster of the Boston Elevated Road. This road is exceedingly crooked, over 40 per cent of the line consisting of curves, many of which are very sharp. There are eighteen of less than 100-foot radius, and sixteen others with a radius of less than 150 feet. On the sharpest curve, which is of only 82-foot radius, and where it is claimed that the traffic is heavier than that on any other steam or heavy electric railroad, the life of ordinary steel rails averages only forty-four days, the head of the rail wearing down from 0.60 to 0.77 of an inch in that time. The great inconvenience caused by the constantly-recurring repairs led the company to experiment with hardened steel rails, and when some nickel-steel rails were put in on the curve, the wear was reduced to 0.53 of an inch in 204 days. A manganese-steel rail is now being used with good results, and the wear on these is only about 33 per cent as rapid as that of the nickel-steel rail, and about 6 per cent as rapid as that of the carbon-steel rails.

COAL SUPPLY OF THE FUTURE.

The report of the Royal Commission on the question of the amount of coal still available below the surface of Great Britain, comes as a flat contradiction of those alarmists who take pleasure in telling us that, within such and such a limited time, we shall have dug all the coal out of the earth, and shall have to depend upon some other kind of fuel. The conclusion arrived at by the Commission as to the amount of coal underlying the United Kingdom that is available for working is that over one hundred thousand million tons can be obtained whenever future generations see fit to bring it to the surface. During the last thirty-four years nearly five and three-quarter billion tons of coal have been mined in Great Britain, and the amount still available is, to give the exact figures of the report, 100,914,668,167 tons, so that if coal were to be mined at the average rate per year of the past thirty-four years, there is enough coal available to last for over six hundred years to come. The Commission states, however, that the above figures do not cover the full resources, since they refer merely to the supply available in the coal fields lying at a depth of less than 4,000 feet, and in seams over one foot thick, these being known as the "proved" coal fields. It is estimated that there will be found in the unproved fields at less than 4,000 feet depths about 40,000,000,000 tons, which amount added to that of the proved coal makes a total of over 140,000,000,000 tons that are still available. This is about twenty-five times as much as the total output of the last thirty-four years. Furthermore, it is estimated that there are in the proved coal fields 5,239,000,000 tons at a lower depth than 4,000 feet, while it is estimated that off the coast of Cumberland and South Wales, there is over one billion tons of coal lying below the sea bed. Although the rapid increase in industrial development, and the consequent increase in demand for coal, render it certain that the next thirty-four years will see a vastly greater consumption than that which has taken place since 1870, it must be remembered that new oil fields are certain to be exploited, and the use of oil fuel widely extended, and that the present activity in the development of the world's water-powers will also assist in keeping down the total demand for coal. It must be admitted that, all things considered, if the condition of things in Great Britain may be taken as representative, the exhaustion of the world's coal supply will take place at such a remote date that it need give us no concern.

BATTLESHIP STRENGTH OF THE NAVIES OF THE WORLD.

Card - H.C.H. Carded E. F.

The British government has recently published its annual return showing the comparative strength of the seven leading naval powers of the world, from which it appears that of first-class battleships Great Britain possesses 53; France, 20; Russia, 14; Germany, 16; Italy, 14; United States, 12; and Japan, 5; while of armored cruisers, Great Britain has 24; France, 17; Russia, 6; Germany, 4; Italy, 6; the United States, 6; and Japan, 8. Of battleships under construction, Great Britain has 8; France, 6; Russia, 5; Germany, 6; Italy, 4; the United States, 12; and Japan, 2; while of armored cruisers under construction, Great Britain has 4; France, 2; Russia, 4; Germany, 1; Italy, 3; and the United States, 2. In this connection we draw attention to the fact that the argument made in Congress against the construction of the two battleships that were recently authorized, on the ground that we have more battleships building than any other nation, is very misleading. If our battleships were built with the rapidity with which foreign nations do similar work, several of these twelve battleships would now be in commission. It is because we are in arrears, and for that reason only, that our list of battleships under construction is so large. If we do not continue to authorize ships at a certain rate per year, we shall ultimately find that in spite of the large number under construction at any given time, we shall ultimately drop behind such a navy as that of Germany, which is being built on a predetermined plan that calls for the placing in commission of a certain number of new ships every year.

SUPERSTITIONS THAT PREVAIL IN RURAL SECTIONS.

That superstition exerts a powerful influence over the affairs of mankind may be ascertained by a residence in almost any rural community in the country. It cannot be said that only the ignorant and uncouth classes give credence to dark sayings. There are thousands of persons who do unacknowledged service to the mysterious and unknown, whose training and education have not succeeded in entirely destroying the effect of potencies and charms learned and believed in youth. Especially is this true if the individual be southern born, for the association and influence of darkies may not be dismissed at a word, and there is no more superstitious class than the southern negro.

It is remarkable how generally sayings of superstition have spread over the country. No section may claim to be above harboring any such beliefs, or rather, practices; for it may not be claimed that all believe in the efficacy who practise and observe certain forms or take cognizance of defined circumstances. Nevertheless, there are, as a matter of fact, few persons who care to pass a pin lying on the ground if the point chance to be toward them. Almost invariably that pin will be picked up. An experiment of this kind was made in Chicago, in an office building, the occupants of which and their visitors should be as free from any touch of superstition as any set of men on earth. But fifteen men out of twenty who passed stooped to pick up a bright pin laid on a dark spot of the velvet carpet in the corridor.

How many persons will confess to a weakness for seeing the new moon over their right shoulder unobscured by any bushy tree top? A greater number will deny the belief in the efficacy who will at the same time confess that they would rather see the moon "right." This remarkable superstition prevails in all parts of the world. Its very universality almost compels belief in its potency.

If one would learn the popular superstitions of any community he must have been reared among the people, for if a stranger were to ask for a list of superstitions prevailing in any one place it is possible no person could recall, or make a list of them. They crop out under suitable circumstances and as occasion calls for their observance.

Below are some of the common sayings in a community made up of descendants of Pennsylvania Dutch, who settled in the Keystone State shortly after the colony was organized:

If in washing the dishes, or in cleaning the table before a meal, the cook drops a dish rag, some one is coming hungry.

If the dish rag is dropped while washing the dishes after a meal, "some slut is coming, if she is not already there."

The crowing of a rooster before the front door early in the morning foretells the visit of a stranger.

If a red bird flits about the yard and chirps merrily, a young girl gayly dressed and light-hearted may be expected soon.

The crowing of a rooster in the night is a sign of hasty news. Thus many a rooster, by a single crow, has cast a gloom over an entire family.

The howling of a dog at night foretells some dire calamity such as a tragic death.

If a dog lies on his back in the front yard with feet extended upward, some member of the family to which he belongs is sure to die soon.

The screaming of a screech owl three nights in succession in or about the front yard, is a sign that some one in the house is in danger of death. To cause the owl to leave, stick the shovel in the fire.

The crowing of a chicken hen portends bad luck. It always results in the death of the hen without delay, for no good woman would allow a crowing hen to live longer than it takes to cut off its head.

In ironing a garment if the smoothing iron is dropped the owner of the garment will never live to wear it out.

Friday is an unlucky day. If a piece of work is begun on that day it will not prosper and possibly the one who begins it will not live to finish it. It probably is true that not ten women out of every hundred can be found who would as willingly start a garment on Friday as on some other day.

If the individuals of a hunting party, in crossing a fence, go over the same section luck will be good, but if several sections be crossed the hunt will be a failure.

If in strolling two persons go on opposite sides of a tree, one or both of them will meet disappointment before the day is over.

Looking at a new moon for the first time through obstructions, as through a tree top, foretells misfortunes during that moon. To see it over the right shoulder and in a clear space brings good luck.

The rabbit always carries omens of ill fortune. If

you meet him on going from home you may look for trouble before you return; if going toward home there will be trouble in your family.

Ashes must not be taken from a fireplace in a sick room. The death of the patient would follow. Nor must the bed of a sick person be turned over. It is actually true that this last provision is believed and actually followed in numberless homes where wealth and culture abound.

No one ever saw a negro meet a corpse. The most courageous darky will go out of his way or turn back upon his path rather than encounter such a calamity. It is said that if you meet a corpse your time will come next. If the corpse is stopped on the way to the grave another member of the family will soon follow.

Kraut must be made in the dark of the moon if it is to be sour.

It is the height of folly to cut a child's finger nails before it is a year old, for then it will pilfer and steal. The nails must be broken and bitten off.

Potatoes and all roots must be planted in the dark of the moon, when it is decreasing or going down in size; likewise crops that grow above ground must be planted in the light, or increase of the moon.

Hogs must be butchered when the moon is increasing, otherwise the meat will shrivel up and fry away in cooking.

A family must never move except in the light, or increase, of the moon. This will secure prosperity and increase of possessions. They will grow as the moon grows. This is another superstition that is in almost general practice in all classes of society.

If a child is allowed to look in a mirror before it is a year old teething will be difficult.

If a coffin containing a corpse be placed so that it is reflected in a mirror, there will be another death in that family inside a year.

The tying of a small sack containing the fore feet of a ground mole assures a full set of pretty teeth. If in teething the child's gums are sore it may be cured by rubbing the gums with rabbit brains hot from the head. Both of these remedies are too commonly practised to excite comment among the people who observe such things.

To remove a wart from the body steal a piece of bacon, rub the wart with it and then bury it under the eaves. Say nothing about this and the wart will soon disappear. The writer removed a number of warts from his own hands when a boy by doing this.

A stray black cat in the back yard foretells good luck.

If a woman is making soap and a man stirs it, all will be well and the soap will be fine, but if a woman comes the soap will spoil in the making.

If you sing in bed you will cry next day. If you sing before breakfast you will cry before night.

If you want a cat to stay at your home, rub its paw on the stove.

To keep a new dog, measure his tail with a cornstalk and bury the latter under the front step.

If you sleep with your feet toward the door you will soon be carried out a corpse.

If an infant is puny and does not grow satisfactorily it must be measured for the "undergrowth." A pow-wow doctor, usually a woman, will strip the child, measure it with a string the same color as its hair, say some "words," bury the string in a secret place and repeat the performance three times. The child will get well. There are dozens of children in a certain Dutch community that were measured in this way and are now pointed to as examples and proof of the efficacy of the method.

In setting out fruit trees a woman must hold the tree while a man sets it and tamps the dirt about the roots. This makes it a sure bearer. This also is practised in numberless communities.

To kill a toad will cause the cow to give bloody milk.

THE FIRST OBSERVATIONS WITH "BALLONS-SONDES" IN AMERICA.

There have been dispatched in Europe frequently during the past ten years *ballons-sondes*, or small balloons carrying only instruments that record automatically the temperature and pressure of the air, thus enabling the temperatures to be determined at the successive heights reached, the place and time at which the balloons fall indicating approximately the direction and velocity of the upper currents. The "aeronautical concourse" of the St. Louis Exposition, says Science, afforded an opportunity to undertake these investigations in this country. Accordingly, the work was taken up by Mr. A. Lawrence Rotch, director of the Blue Hill Observatory, in co-operation with Col. J. A. Ockerson, chief of the Department of Liberal Arts at the Exposition, and a series of very satisfactory experiments has just been completed.

The balloons used in the experiments are the closed rubber balloons devised by Dr. Assmann, director of the Prussian Aeronautical Observatory. These balloons are inflated with about 100 cubic feet of hydrogen gas; they expand in rising until they burst, and then the attached parachute moderates the fall. In some cases two balloons, coupled tandem, were employed, and, as only one balloon bursts, the other is borne slowly to the ground and serves to attract attention. The instruments, which were furnished by M. Teisserenc de Bort, of Paris, record the temperature and barometric pressure upon a smoked cylinder, turned by clockwork; and the lightest of them in its basket weighs about one and one half pounds. A notice attached to each requests the finder to pack the instrument carefully in a box and return either to St. Louis or to Blue Hill, with promise of a reward for the service.

Owing to delays in obtaining the gas and apparatus, the experiments were not begun until the middle of September, during which month four ascensions took place. All of the balloons fell within a radius of fifteen miles, about fifty miles east of St. Louis. Twice the height of nine or ten miles was attained where a temperature of 68 deg. F. below zero was recorded. These experiments were conducted by Mr. S. P. Fergusson, of the Blue Hill Observatory staff. Another series of ten ascensions was executed by Mr. H. H. Clayton, meteorologist at the Blue Hill Observatory, during the last part of November and the first days of December, mostly after sunset, in order to avoid the possible effect of insolation. Fortunately, all these balloons were also recovered, though the stronger upper air currents carried them further from St. Louis, three of them traveling more than two hundred miles, and two, at least, with a speed exceeding one hundred miles an hour, the direction of every balloon being toward the easterly semi-circle. Ten of the fourteen ascensions furnished good records, and the reduction of the later ones reveals lower temperatures than in September, for example, 72 deg. below zero at the height of seven and three quarters miles on November 25, and 76 deg. below at six and one quarter miles on the following day.

The fact that all the balloons were recovered indicates the excellent topographical situation of St. Louis for dispatching them.

A METHOD FOR PUTTING PRINTED MATTER ON FINISHED LANTERN SLIDES.

BY J. A. HONEKING.

Those who make lantern slides know that the best slides, those having the most detail, are those made from negatives first hand, either by contact or by direct reduction in the camera. When a slide is to be made from a photograph or picture of any kind, titles or printed matter of any nature can be copied at the same time the negative is made from which to make the slide; but if a slide be made from a negative first hand, that is without making a print and again copying, as is often done, it is not so easy to put printed matter on the negative so that it will appear on the finished slide.

The following is a method devised by the writer whereby printed matter of any kind may be made to appear on the finished slide, no matter how the slide be made, by contact or by direct reduction from any sized negative. Have the title, phrase, or sentence, or whatever printed matter is desired on the slide, printed in good clear type on smooth white paper, just as you would have it appear on the slide. The printing may be of any convenient size, two or three times as large as you wish it to appear on the slide, or even larger. Place this printed matter on the copying board, and make a negative of it, any size, but not larger than 4 x 5 inches. Develop this negative until the background is quite black or until the printed matter shows slightly on the back side of the plate when viewed by reflected light in the dark room. Printed matter for a dozen or more slides may be copied at the same time on one plate if so desired. When this negative is fixed, washed, and dried, mat out everything, except what is wanted, with black paper. Now place this negative in good light, with the clear sky for a background, or a good white screen of any kind about two feet back of the negative makes a good background. Turn the negative so the printing will be wrong side up and the glass side of the negative toward the camera. By measuring, determine just where you would have the printing occur on the finished slide. Now adjust the camera until the printing shows plainly just where, and just as large as, you wish it to appear on the slide when finished. Next put a lantern-slide plate in the plate holder, and expose twenty to thirty seconds, and develop just as you would a lantern slide.

When this plate is fixed, washed, and dried, it is to be used as a cover glass by placing the film side in contact with the film of the lantern slide.

The printing will now read as it should, and will be in good focus when the picture on the slide is in focus in the lantern.

If the slide is too dense for the printing to show through, the cover may be fitted on the slide and marked, and then by means of a ruler and a sharp knife a space large enough for the printing can be cleared away.

This process may appear to be somewhat long, but in practice is much shorter and easier than it appears, especially when several slides are to be prepared in this way.

It is necessary to first copy the printing, and then copy the positive side of the negative as directed above, in order to make the printing read correctly and at the same time have the film of the cover and the film of the slide bound together, so both may be protected and both in focus at the same time.

SCIENCE NOTES.

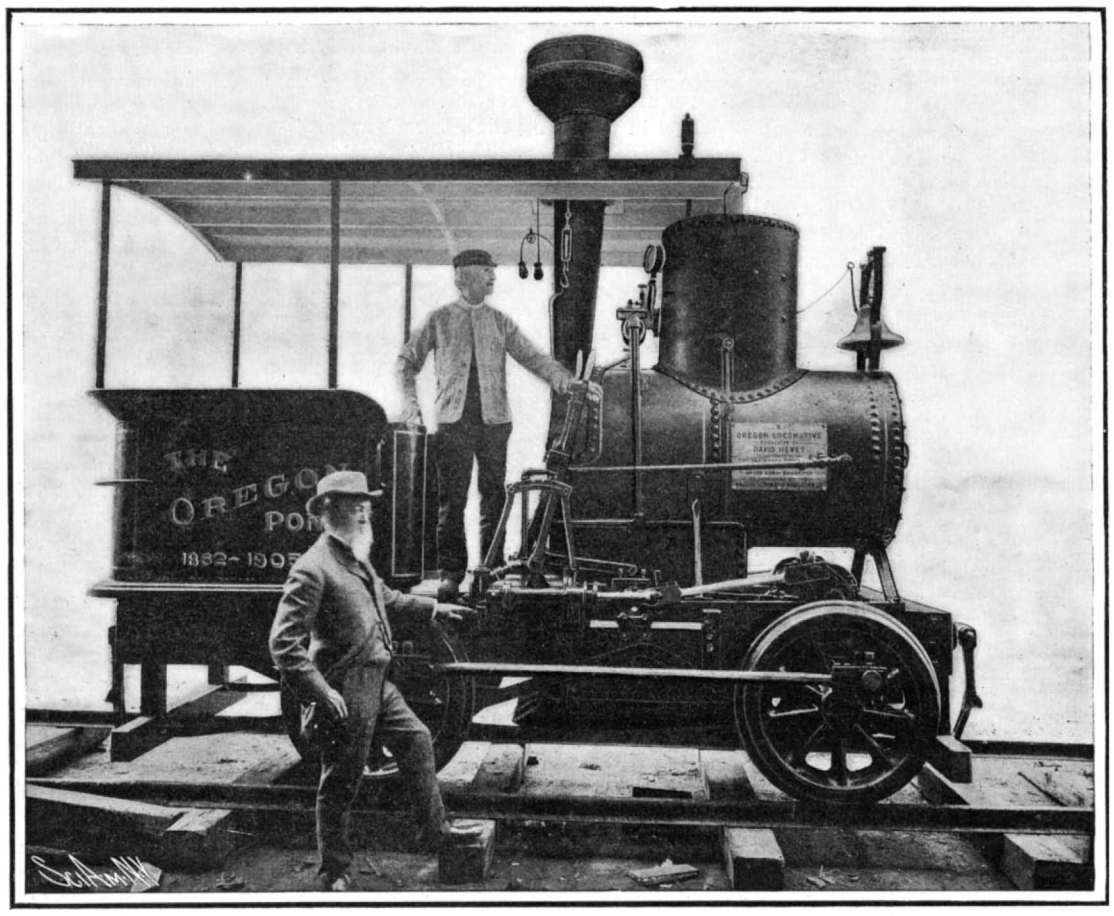
The British Museum has approved of a suggestion for the preservation of phonograph records of the voices of prominent singers, orators, actors, and the works of instrumentalists. When the idea was first submitted to the trustees, the objection was raised that the records would not be of a sufficiently permanent character. This objection has, however, now been removed; and the records for the national collection will be master records of nickel, from which records for service may be molded as desired. A similar collection is already being formed in Italy. The collection for the British Museum is to be started immediately. All the most prominent public men, singers, and musicians of the day will be requested to make records. As years go by, the collection will increase in value and size, and it is certain to become one of the most valued of the nation's treasures. The records, however, will not be available for immediate use, but will be reserved for reproduction in the next generation.

If the open country is to be made attractive to the best minds, it must have an attractive literature. There must be a technical literature of the farm, and also a general artistic literature portraying the life and the ideals of the persons in the country. The farm literature of a generation ago was largely wooden and spiritless, or else untrue to actual rural conditions. The new literature is vital and alive. The new, however, is yet mostly special and technical, with the exception of the growing nature-literature. Artistic literature of the farm and rural affairs is yet scarcely known. Where is the high-class fiction that portrays the farmer as he is, without caricaturing him? Where is the collection of really good farm poems? Who has developed the story interest in the farm? Who has adequately pictured rural institutions? Who has carefully studied the history of the special farm literature that we already have? Who has written the biological evolution progress that attaches to every domestic animal and every cultivated plant? We need short and sharp pictures of the man at his work and the woman in her home—such quick and vivid pictures in words as an artist would throw on his canvas. There is nobility, genuineness, and majesty in a man at useful work—much more than there is in a prince or a general or a society leader, whose rôle it is to pose for the multitude. The man holding the plow, diggin[illegible] ditch, picking fruit, the woman sweeping or making bread—what stronger pictures of human interest can there be than these?

It is said that Dr. D. Dakin has discovered how to prepare adrenalin from coal tar. Adrenalin is the active principle of the suprarenal glands whose isolation has made bloodless surgery possible. Dr. Jokichi Takamine, the Japanese chemist, originally showed the world how to make adrenalin. Over the kidneys of men and animals are two little glands shaped like a cocked hat and, in man, about as big as marbles. Their function was long a mystery to physiologists. Even now, it is not thoroughly understood. It has long been known, however, that they had some effect on the circulation of the blood, and that their secretion is a powerful astringent. Physiologists and chemists began experimenting with this secretion. In 1893 two European investigators discovered that it had a strong effect in driving away blood from living surfaces to which it was applied. In its fresh state it was not of practical use; what science wanted was its active principle. Chemists worked at it for years, and finally, in 1901, Dr. Takamine succeeded. It turned out to be one of the important discoveries in surgical chemistry. In the first place adrenalin drives away the blood from any living tissue to which it is applied. This makes it especially useful in delicate surgery, especially of the nose and throat. Formerly, an operation in the nasal passages, for example, was followed by a rush of blood which hid his work from the operator. Now the surface is treated with adrenalin, and it can be cut like fresh meat. Adrenalin is used by oculists in relieving congestion of the eye. Moreover, it is the most powerful heart stimulant known. Surgeons inject it into patients dying from the shock of operations. It drives the blood ahead of it, giving the heart a quick squeeze, which will sometimes start the engine going after it has practically stopped. Adrenalin is used to relieve violent inflammations and to stop hemorrhages of all kinds—persistent nose-bleed for example. It is rather a costly drug, however, since the process of manufacture from the glands of sheep is long and delicate. A cheap mechanical process of manufacture would greatly extend its use.

A HISTORICAL LOCOMOTIVE.

There has lately been donated to the Lewis and Clark Centennial Exhibition an old locomotive which has had a decidedly interesting experience. Both historically and because of its unique construction, this little engine is worthy of more than passing notice. It was built in San Francisco in 1861, when the old Vulcan Iron Works of San Francisco received an order from the Oregon Steam Navigation Company for a locomotive which they wished to use on a portage that extended around the great cascades of the Columbia River. The portage consisted of a seven-mile stretch of track, laid on the bank of the Columbia on the Oregon Territory side. The first trip of the little engine was made May 10, 1862. The track consisted of stout wooden rails laid longitudinally, which were covered on the inner edges with light scrap-iron plates. The operating company was the subject of much congratulation on the day that the engine drew its first load of freight and passengers around the portage at the rate of ten miles per hour.



THE FIRST OREGON LOCOMOTIVE.

It was not long before a more up-to-date road, with larger cars and more powerful locomotives, was built on the opposite side of the river; and with the completion of the new road the old portage track and its locomotive were dispensed with. The "pony," as the little engine was called, was then purchased by Mr. Hawes, a San Francisco contractor, and brought by steamer down the Columbia and around the Pacific coast to that city, where it was engaged for many years in hauling the sand cars, that were used on a large contract for cutting down the steep hills and filling up the foreshore of San Francisco. After many years of this service the engine was taken off the work and stored in a warehouse, where, in 1889, it was seriously damaged in a fire which destroyed the warehouse. The curious little locomotive was thoroughly repaired by its owner and sent as an exhibit to the Exposition. The engine is about 7 feet in width and 13 feet in length, and weighs 5 tons. It is carried on four wheels, connected by side rods. The boiler is of the return-tube type, and the coal and water are carried on the engine. The cylinders are not connected direct to the driving-wheel axle, but drive the latter by means of a countershaft to which it is geared.

THE COBRA.

BY RANDOLPH I. GEARE.

The Indian cobra, or cobra di capello (*Naja tripudians*) is the most deadly of all snakes. It inhabits India and Ceylon, Burma, the Andamans, southern China, Indo-China, and the Malay peninsula and archipelago. In the Himalayas, its range extends to an altitude of eight thousand feet. To the west it ranges to Afghanistan, northeast Persia, and south Turkestan, as far as the east coast of the Caspian Sea.

Cobras are most active at night. They feed on small animals, birds' eggs, frogs, fish, or insects. They attack hen-roosts, and swallow the eggs whole. They drink a great deal of water, although they can live for weeks, even months, in captivity without touching food or water. Cobras can climb, and occasionally ascend trees in search of food. As a rule, they are not aggressive, and unless interfered with or irritated, they crawl along the ground with neck undilated, looking like some harmless snake; but the moment they are disturbed they assume a menacing attitude. The poison of a cobra, when thoroughly inoculated by a fresh and vigorous specimen, is quickly fatal. Paralysis of the nerve center takes place, and death follows rapidly, sometimes in a few moments, especially when the fangs, having penetrated a vein, inoculate the poison immediately into the venous circulation. The venom is harmless, however, if taken internally, nor is it fatal when brought in contact with a mucous surface, such as the interior of the stomach or the eye. The natives of India distinguish between cobras with spectacles on the hood ("Gokurrahs") and those with only one ocellus, or other mark, on the hood ("Keautiahs"). Dr. J. Fayrer in his "Thanatophidia" mentions the following varieties of the Gokurrah: Kála (black); Koyah (black and white); Gomunah (wheat colored); Puddah (yellow); Dudiah (whitish); Tentuliah (tamarind-seed colored); Kurrees (earthy color); Tameshur (copper colored); and Puddun nag (gold colored). Of the Keautiah: Kála (black); Tentuliah (tamarind-seed colored); Kurrees (earth colored); Sonera (gold colored); Dudiah (whitish); Bans-buniah (mottled white and black); Giribungha (brownish); Koyah (black and white); Sankha-mookhi (black and yellow).

In many parts of India a cobra of any of these varieties is simply called "Kála sámp," or "Nág sámp." Another species of cobra occurs in Africa, where in the northern part it is known technically as *Naja haja*, while in southern Africa occurs a cobra-like snake belonging to a different genus, and known as *Sepedon hæmachates*.

In India the cobra's scientific name, as already stated, is *Naja tripudians*, and while many varieties exist there, it seems to be agreed that they all really belong to one species, a conclusion based on a study of the scales. The average length of the cobra hardly exceeds four feet, with a diameter of two inches, although specimens occasionally attain a length of more than six feet. The largest specimen in the British Museum is six feet four inches in length, the tail being one foot long.

The illustrations of living cobras which accompany this article, and which were obtained for the writer through Dr. Gibson, of the Parel Research Laboratory in Bombay, by Mr. Clarence E. Fee, secretary to the United States consul, show three varieties, commonly known in India as the "black" cobra, the "light-colored spectacled" cobra, and the "dark spectacled" cobra. The "spectacles," being black, are not visible of course on the first, but are plainly seen on the "dark spectacled" specimen. Indian tradition relates that Buddha provided the cobra with "spectacles," to enable it to ward off the attacks of its old enemy, the Brahminny kite. These "spectacles" seem to be restricted to the Indian species; certainly they do not occur in either of the African cobras.

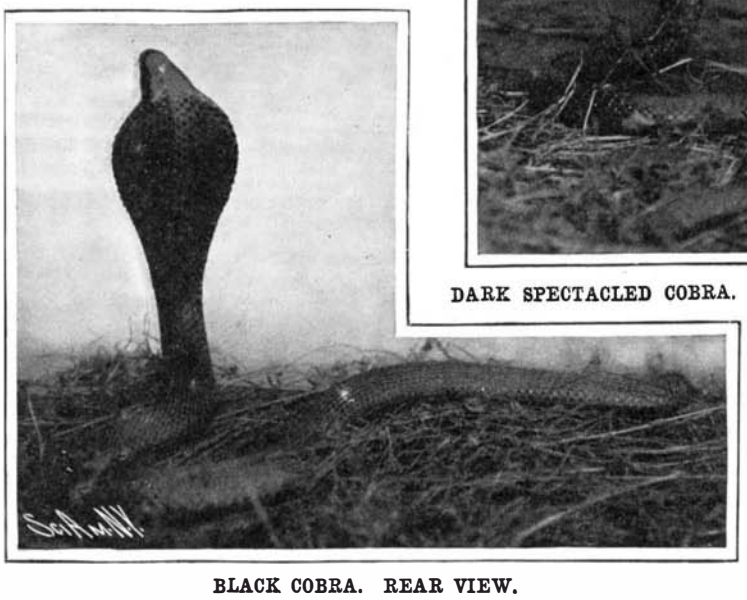
When searching for prey, the cobra glides about easily and quietly, but once excited, he raises his head and a large part of his body straight in the air, while the remainder is gathered beneath in a coil as a kind of support. His next warlike movement is to spread out his upper ribs laterally, extending six or more inches downward from the head, thus converting his neck into a "thin, flattened, oval disk four or five inches broad." This is the "hood" which is found in the Indian, and in a smaller degree on the North African cobra, but is entirely wanting in the form found in South Africa. Above the hood protrudes the head, expectant and held horizontally, facing the foe.

Probably the average annual number of the cobra's victims in India alone, which is placed at about twenty thousand, would be very much greater if it did not possess such a nervous temperament, which often leads the snake to strike at a moving object long before it is near enough to reach the object effectually, thus wasting a large amount of venom.

When a cobra strikes, he hisses audibly and immediately reassumes his erect position, and thus he continues to act as long as danger menaces or a safe avenue of escape does not present itself. The turning to the left and right, as above mentioned, constitutes the so-called "cobra dancing," which many have attributed to the influence of music, but which, combined with the appearance of faintness and death, which these snakes sometimes assume, are properly referable to the natural tactics of defense and attack, while the "fainting" is simply a temporarily weakened condition due to its extremely nervous and excitable disposition.

The Indian cobra must not be confused with the hamadryas or King cobra, which also has a wide distribution in southeastern Asia, through the Indo-Malayan region to the Philippines. It is much larger than the cobra, one recorded specimen measuring sixteen feet nine inches. Fortunately, it is not so venomous as the cobra.

DARK SPECTACLED COBRA. REAR VIEW.



BLACK COBRA. REAR VIEW.

LIGHT-COLORED SPECTACLED COBRA.

OXYGEN AT HOME.

BY EMILE GUARINI.

For some years past oxygen has been employed for numerous industrial, medical, and hygienic purposes; but, up to the present, one of the drawbacks to its use has been the cost of the gas in a compressed state, due in great part to the expense of transportation. This difficulty, however, has been recently overcome by the invention, by M. G. F. Joubert, of a solid product styled "oxylith," which disengages absolutely pure oxygen through a simple immersion in water. Every one, therefore, may have at home a supply of latent oxygen, just as the bicyclist and automobilist has a supply of carbide for the manufacture of acetylene.

The boxes of oxylith are even so arranged that they can be directly utilized as gas generators in case of necessity. It suffices to puncture the bottom of the box with a drawing pin, and, after this has been done, to remove the strap that holds the plug, and then to unscrew the latter, and replace it with another provided with a nozzle. The box is then ballasted by means of a weight, and upon the nozzle is placed a rubber tube with which is connected a glass washing bottle provided with a filter of hygroscopic cotton, which completely arrests the water. The box is then submerged in a pail of water, and the disengagement of oxygen begins. Each box furnishes one cubic foot of chemically pure oxygen. In order to further facilitate the immediate and extended use of oxygen, the Société Française pour les Applications de l'Oxygen, which is exploiting the Joubert process, and which owns in the department of Isère a factory utilizing a 10,000-horse-power head of water, and has a capacity of producing 5,000 tons of oxylith a year, has devised a life-saving box (Fig. 1) for the use of physicians, pharmacists, and firemen, and for use in mines, gasworks, blast furnaces, public baths, etc. This box measures 10 x 5.5 x 10 inches and weighs 7 pounds. It contains all the necessary apparatus for the use of oxygen in cases of asphyxia, viz., three boxes of oxylith like those mentioned above, a washing bottle, drawing pins, a ring of lead for ballasting the box, a rubber tube, a plug with glass tubes, a tube for nasal insufflations, a device for effecting rhythmic tractions of the tongue, and a collapsible rubber pail for the submersion of the boxes of oxylith.

Fig. 3.—Large-Sized Oxygen Apparatus.

In addition to the rudimentary apparatus that we have mentioned, the Société, which has a branch house at Paris, is manufacturing gas generators of various types for domestic uses. Figs. 2 and 3 represent the types giving a small, medium, and large discharge. The small discharge generator (Fig. 2) which is entirely of glass, except the upper part, is designed especially for pharmacists and chemists. It may be employed also for rendering the air of apartments wholesome. It consists essentially of a large glass flask with a nickel-plated cap and is capable of producing 2.6 cubic feet of oxygen, without recharging. For charging the apparatus, the metallic upper part is unscrewed and raised in such a way that the central tube and the basket may be removed from the oxygenator. Some oxylith is placed in the basket and the water is renewed if need be. The water that has been used, diluted to one-tenth, constitutes a good wash liquor for domestic purposes.

The apparatus giving a medium discharge (Fig. 2 at the left) differs from the preceding only in size. It is adapted for supplying oxyhydrogen, oxyetheric, oxyacetylic blowpipes, and for the purification of the atmosphere of large halls. It is of enameled iron plate and produces about 5 cubic feet without being recharged.

The portable apparatus of maximum discharge (Fig. 3 on the right) is adapted for large magic lantern exhibitions. It consists of several parts that screw together and are packed in a small case. The apparatus presents the advantage of being easily carried on a voyage. It produces about six cubic feet without being recharged. It includes two reservoirs, one of them for holding the water, which attacks the oxylith, from above, in a perforated basket.

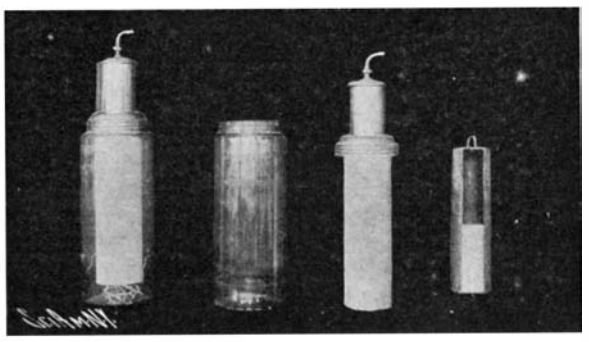


Fig. 2.—Small and Medium-Sized Oxygen Apparatus.

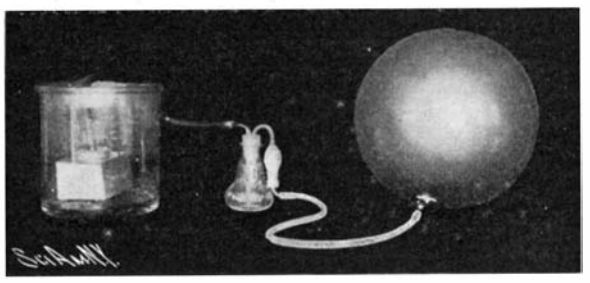


Fig. 4.—Box of Oxylith Used as a Gas Generator.

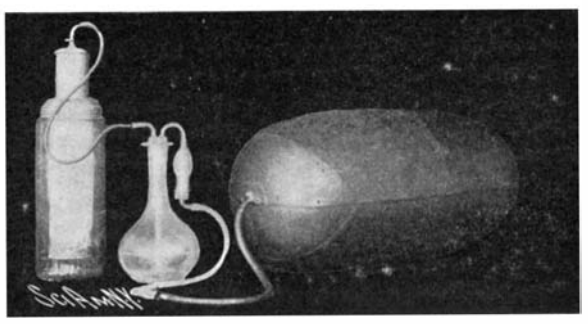


Fig. 5.—Small Apparatus Used as a Gas Generator.

OXYGEN AT HOME.

The oxygen produced in the different manners above described is under a slight pressure. If it is necessary to increase the pressure, it is stored up beforehand in a gas bag. The method of procedure is represented in Figs. 4 and 5. Fig. 4 represents a case in which the box of oxylith is used as a gas generator, and Fig. 5 that in which the gas generator of small discharge is employed. In order to fill the gas bag, the latter is affixed to the tube of the washing bottle and the cock is opened. At the end of ten minutes, the bag will have been filled. After this, the cock is closed and the bag is separated from the apparatus. Its capacity is about a cubic foot. The washing bottle contains nothing but water. It is also interposed as a saturator between the gas bag and the inhaler. If the inhalation is completed by a volatile substance, such as bromoform, terebinthine, thymol, menthol, etc., such substance is poured upon the filter of cotton wadding. As may be seen from what precedes, M. Joubert's discovery has made of oxygen a convenient and cheap agent that is within reach of every one.

Card - H.C.H. Carded E. E.

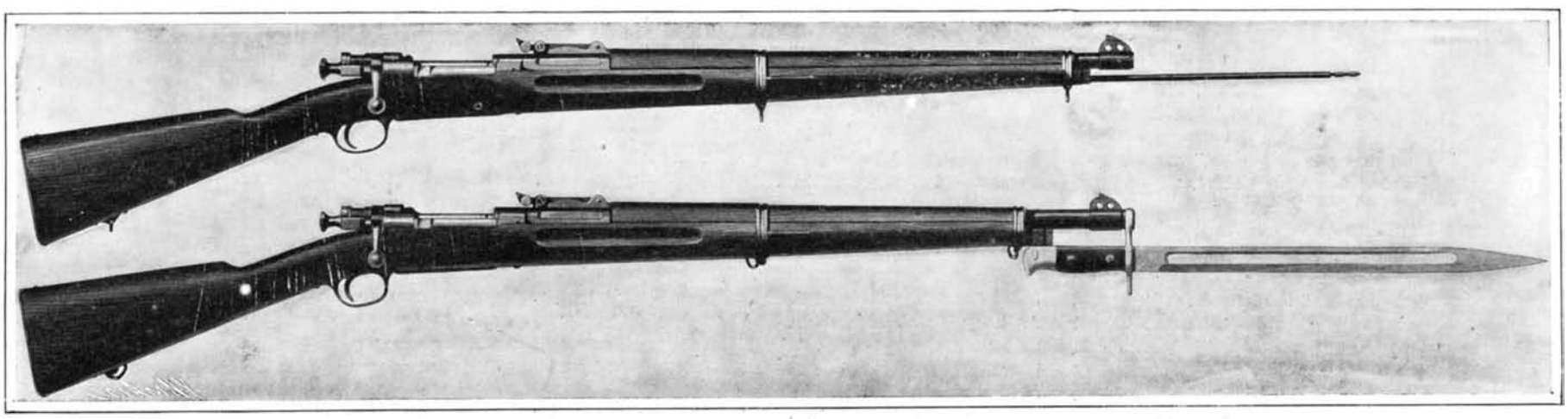
THE RENAISSANCE OF THE BAYONET.

How greatly wide of the mark academic discussions of military matters may lead us, has been well illustrated in the matter of the United States army bayonet. The increased range and great accuracy of the modern rifle, and the good use of it made by the Boer sharpshooters in their late war, had led to the belief that in future wars fighting would be carried out at so great a range that the bayonet would seldom be brought into use. It was considered that the losses by an attacking party would be so great that they could never, or at least very rarely, hope to take intrenchments by storm and turn the enemy out by hand-to-hand fighting. Our own ordnance officers were so much impressed with these supposed facts, that in the new Springfield army rifle, which was being manufactured at the time of the opening of the Russo-Japan war, the bayonet was practically abandoned and a small, round steel rod, about a quarter of an inch in diameter, substituted in its place. The rod was a perfectly useless element in the rifle, being too weak for hand-to-hand fighting—indeed, its existence in the rifle at all must be looked upon as a concession to long-established habit.

The Russo-Japan war has taught us that the bayonet is by no means an obsolete weapon. In the fierce fighting at Port Arthur it was used freely both by day and night. Positions were taken, retaken, taken again, to be retaken once more, and in every case the work was done in hand-to-hand fighting, and with the bayonet. The estimate as to the losses that attacking troops will stand before they break and retreat, has been shown, at least in the case of Japanese troops, to be entirely at fault. An attack that lost twenty-five per cent of its forces was supposed to end in failure; but the Japanese have lost twice and three times that number in the face of a most murderous machine gun and rifle fire, and the remnant has swept on to turn the enemy out of the trenches at the point of the bayonet. The evolution of the United States army rifle, during the past two years, is shown in the accompanying illustrations. The original pattern of the new Springfield army rifle, designed to replace the Krag-Jorgensen, was built with a 30-inch barrel and it was provided with a ¼-inch-diameter round steel rod, which took the place of the ordinary bayonet of sword or triangular shape. This piece had a velocity of 2,300 feet per second, and it fired a 220-grain bullet with a charge of 43.3 grains of powder. In addition to having the highest velocity, it was the lightest of the best-known military rifles. Since the rifle was light and its energy unusually high, with such a heavy charge the recoil was, of course, excessive; and this was one of the objections urged against the new type. The wear on the rifling is also very severe. The ballistics of the piece, however, are exceptionally fine, its maximum ordinate for a 1,000-foot range being only 20.6 feet, as against 25.8 feet for the Krag-Jorgensen.

Fig. 1.—Portable Oxygen Apparatus.

Five thousand of the Springfield rifles with the 30-inch barrel were ordered for trial in the field; but while these were under construction, the Ordnance Board decided to design one that could be issued to both branches of the service, cavalry and infantry. Accordingly they cut off 6 inches from the barrel, reducing it to 24 inches, or 2 inches longer than the cavalry carbine. They carried the hand protection from the middle band, at which it stopped in the 30-inch barrel type, up to the second band, thus practically covering the whole barrel. This piece also had the



The New Springfield Army Rifle, Showing the Discarded Rod Bayonet and the Formidable Sword Bayonet Which Has Been Adopted.

THE RENAISSANCE OF THE BAYONET.

rod bayonet, which was carried permanently below the barrel in the position occupied by an ordinary ramrod in the old muzzle-loading musket. The rod, it should be mentioned, was provided with a catch, which enabled it to be drawn forward until several inches of it projected beyond the muzzle for use as a bayonet.

The five thousand 30-inch barrel rifles were never issued except for purposes of test. The manufacture of the 24-inch barrel type was commenced, and over one hundred thousand were made, and were to have been issued on the first of January, 1905. But the reports received from our army officers detailed to observe the Russo-Japanese war spoke so favorably of the good work done by the bayonet that a committee was appointed to consider the whole question, with the result that the type of sword bayonet shown in our illustration was adopted. The bayonet which has finally been adopted, is 16 inches in length. This adds to the total length of the gun, from butt to point of bayonet, the 6 inches which were lost when the barrel was reduced from 30 to 24 inches in length. The bayonet is made of a quality of steel which will take and hold a fine edge, and it is supposed to be kept sharp at all times. The front of the blade is sharpened throughout its entire length, and the back is sharpened to a length of 5 inches from the point of the blade. There can be no denying that the general appearance of the gun is greatly improved, to say nothing of the great increase in its efficiency by the substitution of the sword bayonet for the old ramrod type.

START OF THE OCEAN RACE.

The positions of the yachts soon after the start of the 3,000-mile ocean race for the Kaiser's cup, which took place under gloomy skies and in a raw and chilling east wind, seemed to the eye of many of the yachtsmen who witnessed it to be prophetic of their position at the finish. There was a light head wind and a decidedly lumpy sea, which served at once to demonstrate the relative ability of the contesting yachts under two very material and important conditions; for while the wind was about the worst possible for the square-rigged vessels, it showed the fore-and-aft yachts to their best advantage; whereas the short, steep seas, which did not bother the big fellows, were particularly trying to the smaller craft, and especially to such as carry the spoon-shaped bow that has become so fashionable in late years. The starting line at the Sandy Hook lightship was laid so that the yachts had to go over on the port tack. At the preparatory gun the schooners and the one yawl entered in the race were grouped conveniently near to the line, with the big "Valhalla" a quarter of a mile to the northeast, and "Sunbeam," "Fleur-de-Lys," and "Apache" yet further away, the last-named having fully a mile and a half to cover before she crossed. "Valhalla" and "Utowana" went over on the wrong side of the committee boat and, of course, were recalled, and the big ship had to pay the penalty of losing something like three-quarters of an hour in the light air before she finally got across between the lightship and the committee boat.

There was but little of the preliminary maneuvering which is one of the interesting features of an "America" cup race, the skippers evidently realizing that in a 3,000-mile race, which might last anywhere from fourteen to twenty-one days, or even longer, the mere question of weather position at starting was not worth consideration. The first to cross the line was the "Ailsa" at 12.15, and close at her heels, but to leeward, was the schooner "Hildegarde." Half a minute behind was the stately three-masted schooner "Atlantic." A minute later came the record-holding schooner "Endymion," and half a minute behind her was the schooner "Hamburg," on which the hopes of Germany are centered. The "Thistle" crossed about three minutes behind the "Ailsa," and these five boats formed a division by themselves. The little "Fleur-de-Lys," which essayed to sail from Sandy Hook to the starting line, was nine minutes behind the "Thistle." Five minutes later the veteran "Sunbeam" made a charming marine picture, as she swept over the line, and three minutes astern of her came that handsome bark, "Apache." "Utowana" and "Valhalla," which would have crossed close at the heels of the schooners had they been on the proper side of the committee boat, did not get across until twenty to thirty minues later, the "Utowana" going over the line at 12:55 or forty minutes behind the "Ailsa;" and the "Valhalla," which went into irons in returning for a true start, did not get across until five minutes past one.

The "Ailsa," with a new racing mast several feet longer than her old mast, evidently was wearing her old mainsail, for there looked to be six or eight feet between the jaws of the gaff and the hounds. She spread a jib-headed jigger, and her small jib-headed topsail wanted many feet of reaching her topsail halyard block. Altogether, she looked to have a very snug spread of sail for the trip, and should she be caught in a blow, by using her long gaff at the foot of a storm trysail, and a storm jib, she should be able to take the worst that comes her way. She pointed high and slipped along very sweetly, pulling out rapidly ahead of "Hildegarde." But the big "Atlantic," carrying what is practically her full racing rig, was just astern, and closing up steadily on the leaders, she quickly passed to windward of the "Hildegarde," drew through the lee of "Ailsa," and footing surprisingly fast in the light air, and looking fully as high as the yawl, she began to demonstrate that her reputation for fast work to windward was well earned. A few cables' length astern of these three were the "Endymion" and "Hamburg," and there was much speculation as to how the Watson schooner, probably the best boat of any kind the late designer ever turned out, would do against the well-tried ocean racer. The question was not long in doubt, for in spite of her greatly reduced rig, the long, lean craft, rising and falling to the seas with an easy rhythmical motion that won the hearts of the yachtsmen on the accompanying tugboats, caught and quickly passed the "Endymion" and began rapidly to cut down the lead of the "Ailsa." She seemed to be making even easier work of it in the short seas than was the "Atlantic." She pointed as high, and at times seemed to hug the wind even closer, and she warranted the statement, recently made to the writer by Mr. Gardner, the designer of the "Atlantic," that the Watson boat was the "Atlantic's" most dangerous competitor. The New York Yacht Club tugboat, from which we watched this most interesting start, followed the yachts until they had made about fifteen knots on their first leg. The tug finally steamed up abreast of the leader, the band playing the national anthem, and wished her godspeed on her long passage. She then dropped back to the "Atlantic's" German rival, and the "Hamburg" was bid adieu to the strains of the German national anthem. As the yachts vanished in the mist, it was seen that "Atlantic" was in the lead by about a quarter of a mile, and that "Hamburg" not only seemed to be just about holding her own, but was pointing higher. A steam yacht which followed the "Atlantic" all night reported that at 7:45 the "Hamburg" was leading and one mile to windward of "Atlantic." A few cable lengths astern of "Hamburg" was "Ailsa," with "Hildegarde" footing about as fast as the yawl, but far to leeward. "Thistle," whose owner is largely responsible for the revival of interest in ocean racing, did not seem to be doing so well to windward in the light air and choppy seas. Her turn, however, will come when the wind freshens and sheets can be started in a reaching breeze. "Endymion" was the first of the yachts to break tacks, which she did soon after being passed by "Hamburg," being soon lost to sight in the haze over toward the Long Island shore. The little "Fleur-de-Lys," which carries the only lady in the race, the daughter of the owner of the yacht, was holding up so high, and footing so well, and withal taking the sea so comfortably, as to augur well for her ocean passage. The New York Yacht Club boat picked up every one of the racers in turn, treated them to some national air, three hearty cheers, and a hearty godspeed. "Sunbeam," "Apache," and "Valhalla," hugging the light air as closely as their sharply-braced yards would allow, but heading nevertheless for the South African coast, were the last to be spoken, and as the strains of "Rule Britannia" were wafted over to the stately "Valhalla," she vanished in the mist, the last at the start, but not by any means necessarily to be the last at the finish of this splendid ocean contest.

The Current Supplement.

The English correspondent of the SCIENTIFIC AMERICAN concludes his interesting discussion of the Hydraulic Power Works on the River Glommen, Norway, in the current SUPPLEMENT, No. 1534. Excellent illustrations accompany this last installment. Fifteen years ago many engineers looked askance on the use of concrete. Nowadays there is hardly a structure which does not depend in some way upon the use of concrete, or concrete reinforced by steel. An excellent article on the wide use of reinforced concrete will, therefore, be read with considerable interest. Mr. Dugald Clerk's recent course of lectures on the gas engine is abstracted. Lead pencils we use every day are described and illustrated. Karl F. Kellerman writes on copper as an algicide and disinfectant in water supplies. The limits of sensibility of odors and emanations is discussed by M. Berthelot. Frederick V. Coville writes interestingly on desert plants as a source of drinking water. The printing telegraph invented by John C. Barclay of New York, and experimented with successfully last December, is fully described.

The steamship "Terra Nova" has been dispatched from London to relieve Anthony Fiala, head of the Ziegler North Pole Expedition. She will go to Franz Josef Land in search of the expedition headed by Mr. Anthony Fiala of Brooklyn, N. Y., on board the steamship "America," fitted out by Mr. William Ziegler, of New York, to attempt to reach the North Pole by way of Franz Josef Land.

The "Terra Nova" is coaled and provisioned for eighteen months. Drs. Samuel Jackson and Frederick M. Mount are among those on board. The crew are mostly Scandinavians.

Electrical Notes.

Continuous Current of Seventy Thousand Volts.—French electricians have prided themselves on attaining a voltage of 60,000 volts in alternating current for industrial establishments. Now, it seems that M. Renethury has attained 70,000 volts in continuous current. Three dynamos coupled in series give under this voltage a power of 70 kilowatts, the current having an intensity of 1 ampere. The difficulty he encountered in avoiding sparks, owing to the difference of potential, 500 volts, between two segments of the commutator, was overcome after various experiments and trials by placing a condenser after each segment. Many experiments were also conducted for determining the most advantageous insulator. This is not M. Renethury's only feat. He originated the hydro-electric installation of Lausanne, in which 5,000 horsepower is transmitted under the tension of 25,000 volts in continuous current.

The state railroads of Prussia are to use De Laval steam turbines combined with dynamos for lighting a certain number of express trains. The turbine and dynamo are built together in a compact group, which is then mounted upon the locomotive boiler. The turbine is said to give 20 horse-power and run at 20,000 revolutions per minute. The dynamo which is used here will furnish 180 amperes at 68 to 90 volts. Each car of the train is provided with a battery of 32 storage cells. The incandescent lamps used for lighting the train will run at 48 volts. The difference in voltage is absorbed by an iron wire resistance on the same principle as the resistance used in a Nernst lamp, so that the tension at the lamp remains constant in spite of the variations in the battery during the charge and discharge. Generally, the dynamo and battery are run in parallel, and a special device consisting of a red lamp placed in the motorman's cab is used. The lamp lights up whenever the voltage of the storage battery becomes equal to that of the dynamo, and indicates the moment when the charging of the latter is to be stopped.

In a paper presented to the Academie des Sciences, M. Einthoven describes a new form of sensitive galvanometer which he has devised, together with some experiments which he carries out by applying this very sensitive method of measuring electric currents to the study of the electrical condition of the human body. In the latter case it is especially the electric effects produced by the heart which he observes. The new galvanometer is one of the most sensitive which is known, and at the same time very precise, so that the smallest variations of current can be measured, down to 10^{-12} ampere. It is formed of a silvered quartz fiber which is stretched like a violin cord between the poles of a powerful electro-magnet. When a small current passes in the wire it is deflected perpendicular to the lines of the field and the deflection can be measured directly by means of a microscope carrying a micrometer. The sensitiveness of the instrument can be regulated by adjusting the length of the wire, so that it will measure in the region of 0.001 down to 10^{-11} amperes. The movement of the wire and its variations can be registered by the photographic method. The image of the middle of the cord, magnified 600 diameters, is projected upon a slit which is placed perpendicular to the image. In front of the slit is a cylindrical lens whose axis lies perpendicular to the slit. A photographic plate receives the image which is thus concentrated to a point, and by moving the plate a curve is obtained which corresponds to the current variations. The image of a scale is projected on the plate at the same time in order to measure the curves. The new instrument allows of making measurements which could only be observed heretofore with the electrometer. One of these is the study of radium, which is now made with a gold-leaf electrometer. It will prove especially useful in physiological work for studying the nerve currents. In the case of the frog we observe the currents of the sciatic nerve, for instance. The electric action of the human heart has been observed heretofore with the Lippmann electro-capillary instrument. The muscular shocks of the heart-beats are known to produce variations in the electric potential of the organism, and this was brought out by Waller in 1899. The currents are registered with the Lippmann instrument, but this has many disadvantages, owing to the inertia in the oscillations of the mercury column. The present instrument is more sensitive and works more quickly, as the light quartz fiber, in spite of its length, has but little inertia and can register the variations of current more exactly, and again, the displacement is proportional to the current. M. Einthoven has obtained a series of curves in the shape of regular waves which correspond to the heart beats and show how the electrical effect varies. The effect is, in fact, quite considerable and indicates the great variations of electric potential in the different parts of the body which accompany the muscular shock of the heart. The waves he obtains are similar in form to those of the Marey cardiograph register.

Correspondence.

Freaks of the Tornado.

To the Editor of the SCIENTIFIC AMERICAN:

In the Associated Press dispatches concerning the recent tornado in Oklahoma, mention is made of the occurrence of some remarkable phenomena which cannot be explained by our accepted physical laws. Among these is the statement that "all the corpses in the track of the storm were found to be without shoes." "In some instances the hair was taken from the head without injuring the scalp beneath." Similar storms have been reported with like curious phenomena, such as the removal of the feathers from one-half of a chicken, leaving the bird otherwise uninjured; driving of a piece of straw several inches into the trunk of a tree without breaking the straw, etc.

As such manifestations serve as the basis for the study of an unknown element in physics, it would be of great value if as many authenticated instances of this character could be accumulated as possible.

The undersigned would be very glad to communicate with persons having personal knowledge of such unusual phenomena found associated with tornadoes and cyclonic storms: F. PARK LEWIS.

454 Franklin Street, Buffalo, N. Y.

Another Explanation of the Stone Ball's Motion.

To the Editor of the SCIENTIFIC AMERICAN:

I submit the following explanation of the moving stone phenomenon:

Marion is located in a limestone region, beds of which underlie the entire city. In a northerly direction from the cemetery are several quarries, hence frequent blasting. The bed of stone transmits the vibration to the base of the monument, causing the pedestal to vibrate from north to south suddenly, but from south to north more evenly. Now, as the pedestal moves south with a jerk, the ball remains stationary. But when the pedestal moves north, its motion, being slower, overcomes the inertia of the ball, causing it to move south, or revolve.

As to the orientation: West of the city a sewage disposal plant has been under construction. The contractor encountering beds of limestone, proceeds to blast through them, causing east and west vibrations, which causing a compound motion of the ball, makes a spot in the south side appear to move east.

To illustrate the motion of the side of the ball next the base, take a yardstick, place a dollar on it, and holding the stick firmly, with the hand resting on a table, strike the end with a light hammer. The dollar will move toward the end struck. JOHN H. GILLOOLY.

Cochranton, Ohio.

First Arithmetic Published in the United States.

To the Editor of the SCIENTIFIC AMERICAN:

In notice of death of Col. Nicolas Pike (SCIENTIFIC AMERICAN, April 22, 1905, p. 322) it is stated that "Among the curiosities he leaves is a three-sheet autograph letter from Washington to his uncle, Nicolas Pike, commending him as the author of the first arithmetic published in the United States."

But the author (Pike) and George Washington to the contrary notwithstanding, Pike's book was *not* the first arithmetic published in this country. Pike's arithmetic was published at Newburyport, Mass., in 1788.

Hodder's arithmetic was reprinted at Boston, Mass., 1719; but that book was not by an American author.

An arithmetic was published at Boston, Mass., 1729, anonymously, but supposed to be by, and is accredited to, Isaac Greenwood, a Harvard professor, which is believed to be the first arithmetic by an American author published in the United States. It antedates Pike 59 years.

Several arithmetics by foreign authors were reprinted here before the appearance of Pike's scholarly work. See "Notes on American Text-Books on Arithmetic," by James M. Greenwood and Artemas Martin, Report of Commissioner of Education for 1897-98, pp. 796 and 802-809, where Washington's letter will be found. See also Cajori's "History of Mathematics and Mathematical Teaching in the United States," pp. 45-49 (Washington, 1890, U. S. Bureau of Education).

"The Youths' Assistant," by Alexander McDonald, was published at Norwich, Conn., in 1785, three years before Pike's book.

"Elementary Principles of Arithmetic," by Thomas Sarjeant, was published at Philadelphia in 1788, the same year as Pike's book. ARTEMAS MARTIN.

U. S. Coast Survey Office, Washington, D. C.

The "Black Boy Gum."

To the Editor of the SCIENTIFIC AMERICAN:

I write to you at this time at the request of a few friends, who are deeply interested in one of the products of Western Australia, namely, what is known as "black boy gum." I do not know what the technical name of it is. Much has been said about it, but we have heard of no real practical analysis and suggestion as to what commercial value it has, or what useful products may be derived from it. There are millions of tons of it, and it can be very cheaply placed on board ship. It is highly inflammable, and has been suggested as an excellent composition for fire kindlers. As a gum, we suppose it may be an excellent base for varnish or a sealing wax. The aboriginals employ it in sticking on their spear heads, etc. From the smell of it we would consider that it possessed some chemical properties that may be of commercial use, it may be in the healing arts or medicine. The bees utilize it largely, and the honey gathered while it is in blossom possesses its peculiar flavor. The leaves of the tree resemble a great grass bulb top, with the flower growing out of the top. The whole of the stem is of gummy scales. The diameter ranges from 4 inches up to 12 or more inches, and the height to 12 or 15 feet. They grow on ironstone ridges very thickly together. The core is quite soft, and one or two blows with the ax will lay them at our feet, but some of the best gum is immediately under the surface, and can be dug up with no trouble at all. A man could cut and load a great many tons in a day, as it is light and convenient to handle, only it is a bit sticky. Now, we wish to ask the favor of your assistance, knowing that through your most valuable paper you have access to the best means of ascertaining the real value of this commodity. You doubtless know of some firm who will have enterprise enough to find out the chemical properties, etc., of this article, and who would probably develop from it a new industry. We have no means of applying the requisite tests in this State, but we should be most willing to undertake the shipment of an unlimited quantity if we had the *bona fides* of a good firm, American, British, or Continental. In the mean time, I possess a small parcel of a few pounds weight cleaned and ready for analysis, and would forward it to a reliable firm for a genuine test. GEORGE JOHNSTON.

Sterling Terrace, Albany, Western Australia.

Wisdom of the Amalgamation of the Line and Engineer Corps of the Navy.

To the Editor of the SCIENTIFIC AMERICAN:

There has been a great deal said against the amalgamation of the line and engineer corps of the navy, which took place by act of Congress in 1899; but if the subject is carefully studied, it will be seen that it is the best arrangement.

The engineer corps was not abolished, and the standing of the engineer was not degraded, as has been said, for the line officer is now an engineer officer. Those who are not competent can qualify themselves in either branch, if below forty years of age, and all the younger ones can easily be given a training which will make them competent. Every commissioned officer doing deck or engine duty on a ship should be trained to do either, in case part of the complement is killed in action.

No commanding officer who is not an engineer has the knowledge which will enable him to get the best results out of his ship. Too often do commanding officers, who are without engineering training, treat the engine department as if it did not belong to their ship at all; and instead of helping along the officer in charge of it, many obstacles are often thrown in his way, and it is very hard to keep the department in a thoroughly efficient condition. All commanding officers should know what can be gotten out of the machinery and the men of the engineer force under different conditions, and also they should thoroughly understand the difficulties to be surmounted in overhauling and making repairs, and keeping the department in a thoroughly efficient condition. They would then certainly think the engine department as much a part of their ship as any other, and would always lend it a helping hand.

There was no mistake made in the amalgamation of the line and the engineer corps of the navy. What the navy needs is more officers. Those that desire to, can qualify for engineering duty only. When there are sufficient commissioned officers to give each ship the number for engineering duty that she needs, there will be a great improvement. A battleship should have a chief engineer and six assistants, commissioned officers, instead of a chief engineer and one assistant, as is the case at present. This shortage of commissioned officers has thrown great strain on those doing engineering duty on the ships.

The warrant machinists are a worthy class; there are doubtless some exceptions, but the greater part of them have neither the education nor the training to fit them for engineer officers. An educated engineer officer is necessary to obtain the best results.

There is really nothing necessary to the proper running of a ship in either deck or engine department that cannot be accomplished, with application, by an educated person brought up to sea life. If one has never seen a ship or a machine shop before, the United States laws allow him to qualify as master of ocean steamers in five years, or qualify as chief engineer of ocean steamers in six years, in the merchant service. Those who wish to specialize along the lines of designing and building machinery and ordnance, and otherwise, can do so, as particular aptitude shows itself. As years go by, the mechanical appliances on board ship are increasing. Every part of a gun is a machine. Everything is done by machinery. Seamanship has gone, and all that remains is handling a ship under steam and the navigation. What is needed now is engineers with training in navigation and in handling steam vessels. The all-around training and manual dexterity of Admiral Cochrane, R.N., who could show every man aboard, except the doctor, how to do his work, is as much needed now as it was then.

A CHIEF ENGINEER NOT IN THE NAVY.

New London, Conn.

Engineering Notes.

A large viaduct is to be constructed across the river Indus at Khushalgarh, one of the largest rivers in India. The bridge is to be of the double-deck type, carrying the railway on the top, with the roadway below. It will have a 470-foot cantilever span and an "anchor" span of no less than 303 feet.

Some new records in railroad speeds may be anticipated in France. A great effort in this direction is to be carried out experimentally between Paris and Bordeaux. The Orleans Company is constructing a special engine, which is to take an express through the journey in six hours. As the distance is about 372 miles, the rate of speed will have to be about 74½ miles per hour for six consecutive hours.

The new Allan transatlantic turbine steamer "Virginia," which is the sister ship to the "Victorian," attained a speed of 19¾ knots against the tide and 20 knots with the tide during her trial trip on the river Clyde. The contracted speed was 17 knots. The "Virginia" is similar in every respect to the pioneer Atlantic turbine liner "Victorian," described in these columns.

In a well-written article published in Revista Militar (Rio Janeiro), Major P. Ferreira Netto presents a very thorough review of modern explosives, some of his information being based upon an article published in the SCIENTIFIC AMERICAN SUPPLEMENT, which article he quotes with approval. From what we read, we take it that Major Netto considers the essay by Mr. Sy a most valuable contribution to the chemistry of smokeless powder. Major Netto is a military engineer of some note and visited this country several years ago to study our military improvements, and likewise for the purpose of making arrangements with one of our smokeless powder makers to build a factory in Brazil.

For some time past experiments have been carried out in England with several media such as westrumite, and so forth, for overcoming the dust nuisance on the high roads, which is created more especially by automobiles. These materials, however, have proved only partially successful. The results of some later experiments in this direction which have been carried out in Liverpool were recently described by Mr. A. Lyle Rathbone, deputy-chairman of the Liverpool Health Committee in a lecture at Liverpool. The surface of a selected roadway was coated with creosote oil mixed with resin. This mixture gave the cleanest and nicest appearance while the surface coated with ordinary petroleum was the least lasting; next in order came mixtures of creosote oil with tallow, and hot creosote oil. Heavy coal tar waste oil lasted rather longer than the creosote oil, and was very much cheaper. Considering the experiments as a whole, the result would seem to point to eventual success with the use of some classes of oil in the place of water on macadam roads.

An interesting application of the gasoline motor for marine purposes was recently demonstrated upon the arrival in the Thames of the auxiliary vessel "Sirra" of 500 tons from Dordrecht. This vessel is a three-masted schooner, and with the large area of sails provided in a fast boat on the high seas. The craft, however, is also intended for service upon canals, for which purpose the masts are hinged, thereby enabling them to be lowered for passage beneath bridges. When the sails are unavailable the boat is propelled by a gasoline motor. There is a small single propeller placed well below the water line. The motor is placed right aft so as to reduce the length of shafting as much as possible, and is controlled from the poop by means of a hand wheel and lever. The provision of this auxiliary power was strongly emphasized upon the arrival of the vessel in the Thames. Instead of waiting for the tide, or requisitioning a tug, the vessel was driven up by the gasoline motor at a steady speed of six knots, and as the masts were lowered could pass beneath the bridges easily. Such a combination of wind and motor power presents many possibilities, since a vessel so equipped has great economy in power, ease in working, and adaptability to circumstances. The "Sirra" was visited by many marine engineers interested in the problem of river navigation during her stay in the Thames. It afforded a concrete example of how the question of dealing with canal traffic may be efficiently and economically handled. Such a system is much cheaper than electrical towage both from point of initial expense and maintenance, and far more expeditious than animal traction for canals and similar waterways.

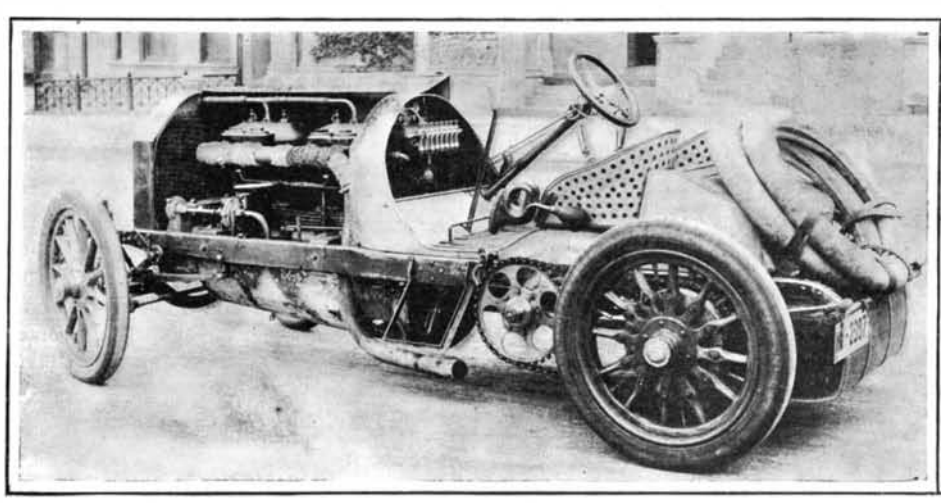
AMERICAN RACING CARS FOR THE INTERNATIONAL CUP RACE.

Attention has been drawn to the nearness of the classic Bennet cup race by the shipment abroad recently of two of the American cars which are to represent our country this year. After the disappointment the American public has had in the performance of the machines that have represented us heretofore, it is gratifying to know that this time, if we do not win, it will not be because we have not truly representative machines, composed of the best material and put together with the greatest skill that America can produce.

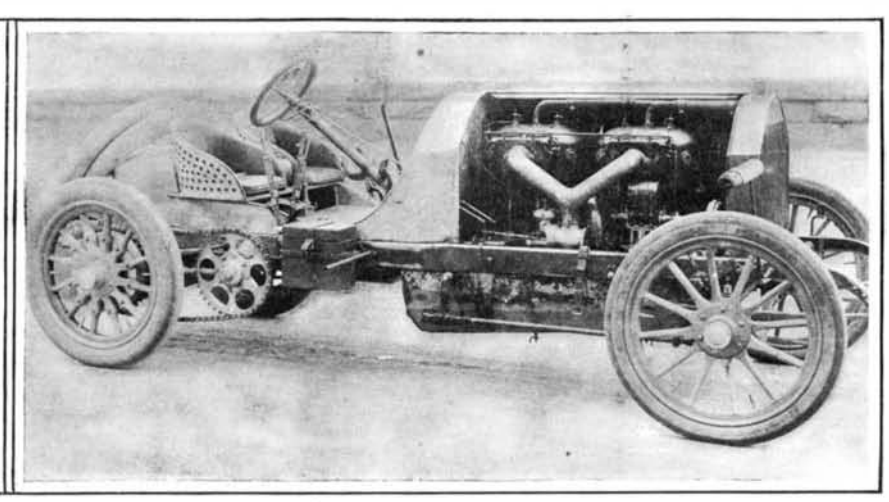
The 140-horse-power Locomobile racer shown on this page is owned by Dr. H. E. Thomas, of Chicago, Ill. It was specially designed by Mr. A. L. Riker, and constructed under his supervision at the Locomobile Company of America's factory in Bridgeport, Conn. Instead of following the usual custom of building a racer first and developing a touring car from it, Mr. Riker has proceeded in the reverse order; and the huge racer is simply an enlarged model of the touring cars the firm is at present producing. Cars of this type have had a thorough test in tours and endurance runs during the past three years, and their reliability is well known; so it is reasonable to suppose that the driver of the racer, Joseph Tracy, will not have to contend with those minor breakdowns that often lose a race.

The photographs of the machine reproduced herewith show clearly its simplicity. The four cylinders of the engine, the bore and stroke of which are each 7¼ inches, are cast integrally in pairs, the walls being as light as possible without sacrificing strength. The crankshaft is of nickel steel, bored hollow to allow of the passage of oil to the cranks, and also to reduce weight. The practice of reducing weight by boring has been carried even to the minutest pins of the car, but has not been used on any parts where it would reduce essential strength in the least degree, such as the axles, frame, etc. There is no fan behind the radiator, which is of the corrugated ribbon type. The motor has mechanically-operated inlet and exhaust valves located in valve chambers on opposite sides of the cylinders. Make-and-break igniters operated from a slidable camshaft, having special cams for varying the time of the spark, are used. The current is supplied regularly from a gear-driven magneto, but two sets of accumulators and a coil are carried in reserve in a box on the frame beside the driver's seat. All these parts are visible in the picture showing the inlet valve side of the motor. The carbureter, spark and throttle levers and their connections, gear-shifting and brake levers, and clutch and brake pedals are also visible in this view, as well as the steering rod running forward to the front wheels from the bell crank depending from the frame, and which is moved by worm gearing at the foot of the steering column when the wheel is turned. The carbureter is of the automatic type, with an auxiliary air valve in the vertical elbow on the left-hand end, and the main air inlet through the pipe below the branch pipe to the right-hand pair of cylinders. This pipe draws hot air from around the exhaust pipe on the opposite side of the motor and has, besides, a shutter (seen open in the portion of it beside the carbureter) through which cold air can enter and regulate the temperature of the air supply. The two small levers below the steering wheel operate a piston throttle valve in the carbureter, and slide the igniter cams respectively. The long vertical lever in the center of the machine throws the clutch in or out directly in case the pedal connection should fail. This lever can be seen better in the other view, which shows the exhaust valve side of the engine, with the huge 3-inch exhaust pipe. One of the arms of the leather-lined flywheel clutch is visible in this view at the rear end of the casing below the motor, and through the step for the mechanic. On the dashboard is seen the oil tank, with its row of eight sight feeds connected by a pipe to its bottom. By squeezing the rubber bulb rapidly a number of times, enough pressure is placed above the oil in the tank to force it up and through the sight feeds for some minutes, whence it goes by gravity to the cylinders and crankshaft bearings of the engine. The oil pump, placed horizontally beside the oil tank, is used to force oil periodically into the crank case. Another small hand pump between the two seats is used to put pressure on the gasoline tank at the rear, for the purpose of forcing gasoline up to the carbureter. The exhaust pressure is not used in either case, the hands of the mechanic solely being relied upon. The centrifugal water-circulating pump is seen at the base of the motor in this picture also, it being on a gear-driven shaft rotated from the incased two-to-one gears at the front of the motor. Two gages above the oil tank show the pressure on the water and gasoline. Attached to the frame and the front axle a V-shaped arrangement known as the Truffult suspension is to be seen. This device consists of two arms pivoted together through a friction joint, which checks the frame from rebounding suddenly when the wheel passes over an obstruction. A car fitted with this device is said to ride smoothly at high speed and on an uneven road. The Richard-Brazier car that won the race last year was fitted with it. The racer has 3½ x 36-inch Diamond tires on the front wheels, and 4½ x 36-inch tires on the rear. Its wheel base is 109 inches and the tread, 54. The frame is of pressed steel and nickel steel is used throughout the car as far as possible. Ball bearings are used in the wheels and transmission. The latter gives three speeds and a reverse. The gears and their shafts are cut from single billets of steel. The transmission gives a speed reduction of 1 to 3 on the low gear, 1 to 2 on the second, and there is none on the high. The large size of the sprockets is to be noted. All of these have 38 teeth. 1¼-inch pitch, ⅝-inch Diamond chain is used. The drive is direct on the high speed, and at 900 R. P. M. of the motor, the car should make 90 miles an hour. The engine is one of the largest entered in the race, surpassing in size all of those on the French cars which are expected to compete. (See Scientific American for May 6th, 1905, for the sizes of some of these.) Its bore and stroke in millimeters are 184. The horse-power that it is capable of developing under the best conditions is in the neighborhood of 140, although the horse-power contracted for by Mr. Thomas was only 90. A brake test has shown 95 horse-power at 700 R. P. M. That it has ample power to hold its own with any foreign machine, can be seen from the fact that it covered 25 miles in 35 minutes over hills recently on the north shore of Long Island, when following Mr. W. K. Vanderbilt, Jr., on his 90-horse-power Mercedes. This is a rate of 42.14 miles an hour. A mile in 42 4-5 seconds was done in a test on a level road, and another in 45 on a 6 per cent grade, which correspond to speeds of 82.8 and 80 miles an hour respectively.

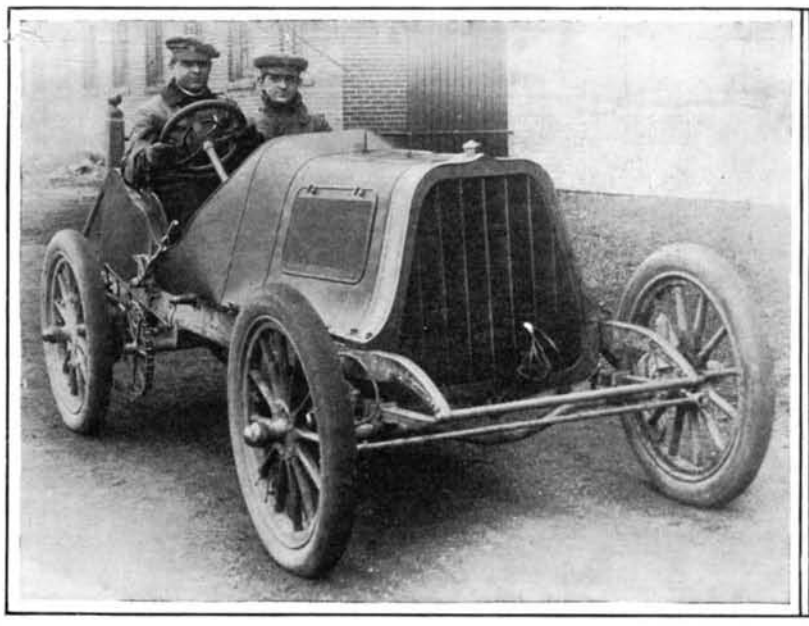
The two Pope-Toledo racers entered for the cup event are rated at 50 horse-power only, and are comparatively low-powered cars. Their general appearance can be seen from the photograph. They are built on much the same lines as the Pope racers which did so well in the Vanderbilt cup race last fall. The engines are fitted with copper water jackets, which are a distinctive feature of all Pope Toledo motors. Jump-spark ignition is used, the current being furnished by batteries. The cars have sliding-gear transmissions, giving only two speeds ahead and a reverse. The final drive is by chains to the rear wheels. Both front and rear wheels are fitted with 4 x 34-inch tires. The wheel base of the cars is 102 inches, and the weight of each is 2,150 pounds. The machines are constructed largely of nickel steel. Both cars were run about 2,500 miles in the vicinity of Toledo, while being tested.



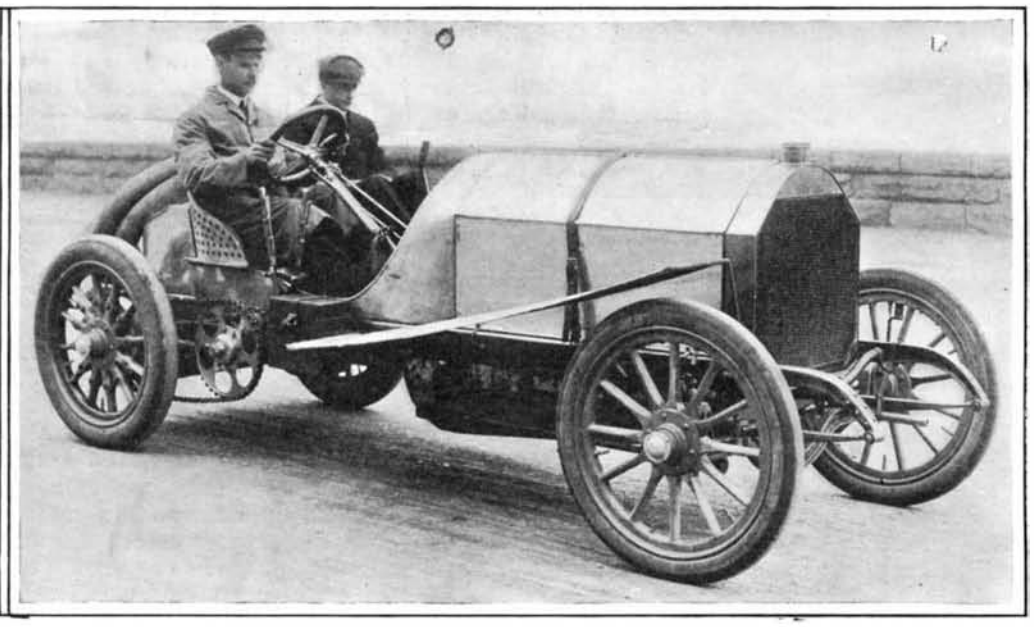
Rear of Racer, Showing the Exhaust Valve Side of the Engine, the Dashboard, and the Gasoline Tank at the Rear.



Inlet Valve Side of Engine, Showing Carbureter, Magneto, and Controlling Pedals and Levers in Front and Beside the Driver's Seat.



One of the Two 50-H.-P. Pope-Toledo Machines, Which Will Represent America in the Race in France on July 5.



The 140-H.-P. Locomobile Car. This Machine Has One of the Largest Engines of Any Entered in the Race.

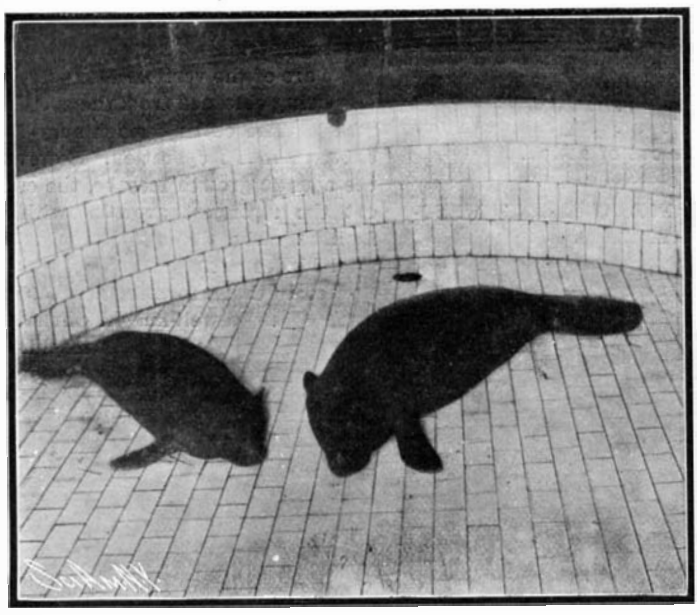
THE AMERICAN RACERS FOR THE GORDON BENNETT CUP RACE.

In September last the railways of the Mexican republic had a mileage of 10,310. This figure refers solely to the federal lines, and does not include those of the States or belonging to companies.

THE NEW YORK AQUARIUM.

BY WALTER L. BEASLEY.

The New York Aquarium at Battery Park is remarkable in more respects than one. Its attendance record of over 1,625,770 the past year, an average of 4,440 daily, stamps it as one of the most popular show-places provided by the city. Two years ago it was turned over to the management of the New York Zoological Society, who fortunately secured as the director Mr. Charles H. Townsend, formerly chief of the Fisheries Division of the United States Fish Commission. Many innovations, such as lighting, beautifying the interior, lining exhibition tanks with rockwork, supplying them with marine and fresh-water plants, so that the fish can be seen with a natural background, have been introduced. A fish hatchery has been established in one of the large floor pools, where the general public can view the process of raising fishes from eggs. The rotunda inclosure, with its one hundred wall tanks and several spacious floor pools, shelters two thousand captive sea-dwellers of different kinds, little and big, perhaps the largest colony of live fishes ever gathered under one roof in the world. Over two hundred different species are represented. The aquarium also has a finer collection of brilliantly-colored tropical fishes than is to be found elsewhere. These include, notably, the spotted and green morays, the latter six to eight feet in length, the blue and green parrot fish, the queer trigger fish, butterfly fish, angel fish, four-eyed fish, mud parrot fish, squirrel fish, doctor fish, and trigger fish. To suit the various temperatures necessary for the various species, the Aquarium maintains four distinct water systems, warm and cold for ocean species and medium and cold for fresh-water types. In mid-winter the water for tropical fishes is daily heated from 38 deg. to 70 deg., and in summer a refrigerator system is put into operation for the benefit of the trout and salmon. Owing to the fact that the floods of the Hudson River saturate and roil the waters of the bay, destroying more or less sea life in the Aquarium every winter, a new reservoir has been constructed to furnish the Aquarium with a good stored supply of salt water from the open ocean. This will permit the introduction of many additional salt-water creatures from along our coasts. A valuable and successful educational feature is provided in the shape of well-balanced aquaria, located in the laboratory for the use of teachers and students from college and normal down to the public and private schools. Mr. L. B. Spencer, of the Aquarium's staff, is in charge of this department. More than four thousand pupils and their instructors availed themselves of the opportunity to engage in this aquatic nature study last year. The length of life of some of the specimens is quite remarkable, considering their confinement, and the fact that they are deprived of natural food. Among the oldest inhabitants are some striped bass, which have been over ten years in the tanks. Another veteran is a monster Mississippi catfish, now weighing about sixty pounds, having increased his weight one-third in four years, and this in spite of the fact that he lies dormant when the water gets cold, and does not feed at all from September to April. The more delicate among the gayly colored tropical fishes from Bermuda, however, begin to die off at the approach of winter and cold weather.

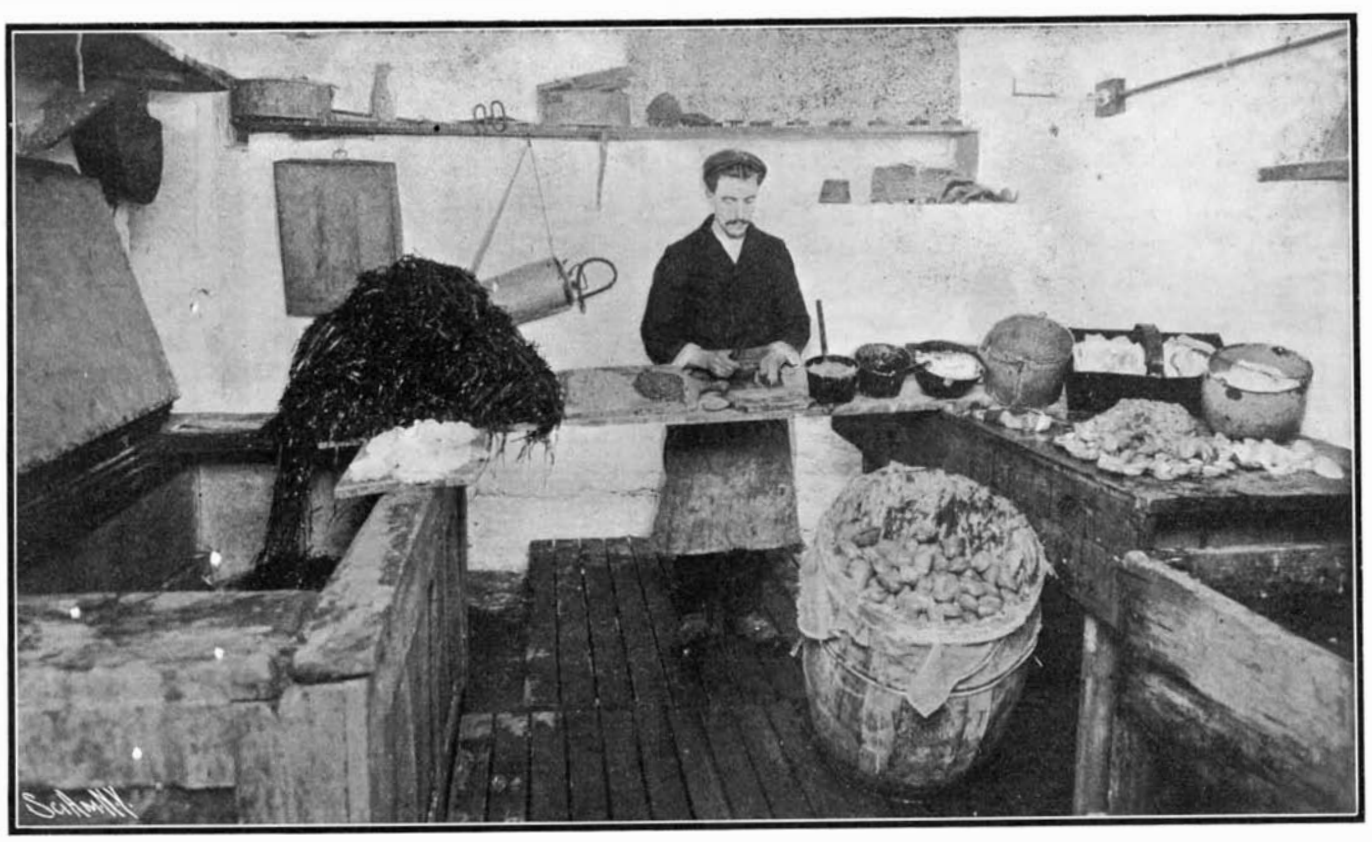


The Sea-Cows Sprawling on the Bottom of the Drained Pool.

The Fish Studio of the New York Aquarium.

The Sea-Cow's Dinner of Eel Grass.

Feeding the Crocodile.



The Fishes' Kitchen. Preparing Dinner for 2,000 Specimens.

INTERESTING GLIMPSES OF NEW YORK'S AQUARIUM.

To obtain photographic records of some of the rare specimens, a portion of the open roof is used as a studio. The desired subject is brought to the roof from the tanks within a deep bucket, filled either with salt or fresh water. By aid of a scoop-net, he is deftly dumped in the waiting glass case. Here his movements are watched, and when a favorable attitude is struck, such as a free swimming one, the whole body clearly outlined, the exposure is made.

One of the busiest places in the Aquarium's plant, and one rarely seen by visitors, is the fishes' kitchen. Here, in a roomy ice-chest, on tables and in barrels, are stored the numerous food-stuffs daily served out to the two thousand finny guests. A steward devotes half of each day to preparing the diversified dishes, which by trial have been found to be the most tempting and agreeable to their appetite. Several attendants are kept busy during the afternoon in serving out the rations. The food varies to suit the size of the specimen, and consists of meat, sliced, chopped, or minced, liver, fish, mostly cod and herring, clams, live minnows and shrimps. The Aquarium collector is kept constantly occupied foraging for foodstuffs in adjacent bays and shores. Natural, live food is preferred in summer time, while in winter a large amount of market food is necessarily

consumed. Oysters and soft-shelled clams are fed to the drums and sheepsheads. They crush the shells, and extract the meat. A dainty dish in the shape of baked cornmeal cakes is given to the carp. Strips of cod fastened on a long stick, and let down in the tank, are kept moving to and fro in front of the open jaws of the green morays, who, if in eating mood, will quickly reach up and swallow the morsels. The board bill for sustaining the vast collection is $100 per month.

Through the courtesy of the director and Mr. W. De Nyse, in charge of the marine department, the writer was afforded special facilities for obtaining typical photographs of the animals around feeding-time, a favorable opportunity for obtaining characteristic and life-like positions. Among the chief attractions of the Aquarium at present, from the fact that they are rare and almost entirely new to popular eyes, are the pair of sea-cows or manatees from Lake Worth, Florida, the only ones in captivity at present. The first successful picture ever secured at close range, showing the peculiar head and nostrils of this creature raised out of water in the act of taking food, is herewith reproduced. In its Florida habitat the animal is especially shy and cautious of man, diving and disappearing instantly on near aproach. Owing to their strange tropical habits, they are given special treatment and care, such as a suitable warm temperature of 70 deg. to 72 deg. for their pool water and the living food. Eel-grass and lettuce leaves strongly tempt their appetites. The former is used in more abundance when obtainable. The larger specimen is a female, eight and a half feet long, and weighs 600 pounds. The male is about two-thirds the size and weight of its mate. They were captured by Alligator Joe, of Palm Beach, a celebrated hunter of that region, and were taken in a large drag-seine. Numerous trials were made for a month, and at least seven manatees broke through the net and escaped, before two were finally secured. They reached the Aquarium in June two years ago, and have considerable swimming space in their tile-lined pool, twenty feet long by thirteen wide, holding four feet of water, which is renewed nightly. Feeding the sea-cows is watched with unusual interest by the visitors. Mr. W. De Nyse, with a suspended handful of eel-grass can coax the female to raise her head and neck completely out of the water. The manatee has a peculiar structure, having no front teeth nor hind limbs nor hip-bones, but being supplied with a huge, beaver-like tail. Its bones are said to be the heaviest known among mammals. The best view of the animal is obtained when the water is drained off the pool for tank-cleaning, leaving the whole form strikingly outlined. When this is done, the large female rolls upon her back, and remains in this position until the water returns. The pair have a habit of keeping close together, and rubbing noses at intervals. The American home of the manatee is the Indian River and lagoons and Everglades of the eastern coast of Florida.

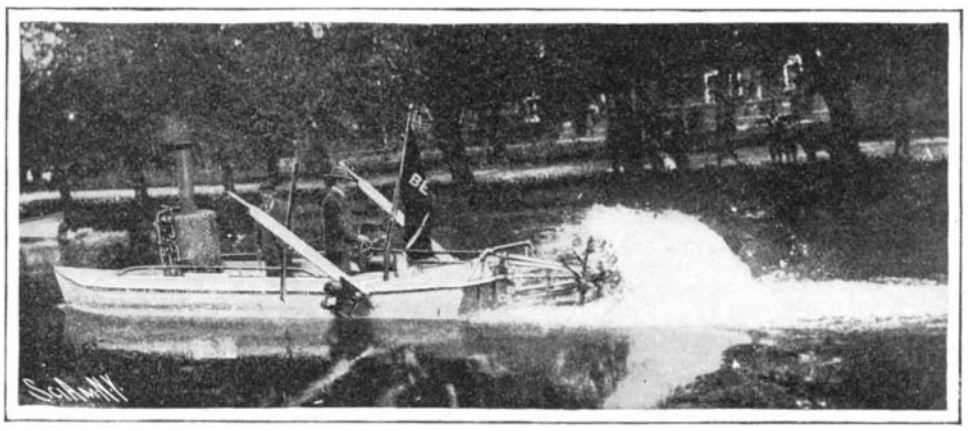
The nine-foot crocodile from the Florida keys is one of the most reluctant and irregular feeders at the Aquarium; days and even weeks will pass before he takes food. He is roused from stupor on being punched with a long pole. He then shows his anger by growling and opening his ponderous jaws, when the attendant swiftly lodges a big fish, which is held in readiness, down his throat. Crocodiles are becoming exceedingly scarce, and liable to ultimate extinction, owing to constant killing in order to obtain their hides. Young ones are likewise sold to tourists for pets, and seldom live more than two years.

An ingenious, compact apparatus, described as a quick-start lubricator box, has been placed on the market in England. The appliance comprises a small horizontal cast gun-metal box, measuring 10 inches in length by 2½ inches wide and 2½ inches deep, provided with a metal lid. At the bottom of the box are arranged a series of orifices corresponding to the number of lubricating pipes which it is desired to connect thereto. For instance, one pipe leads to the crank-pin, another to the slide, a third to the eccentrics, and so on. The part to which each pipe leads is plainly indicated above the respective orifices. Placed horizontally above the orifices, and between them and the bottom of the box, is a small spindle constituting a kind of plug of a multiple cock with a series of longitudinal passages corresponding to the number of pipes. This spindle is carried in a boss at one end, while at the other it extends through a stuffing box and is provided with a small lever. The spindle can be rotated by means of this lever, and all the orifices can be opened or closed simultaneously, and the oil supply connected or interrupted without removing the wicks. From above each orifice in the base of the box extends a small brass tube to within about one-half inch of the top, and there takes the wicks, which siphon the oil to the various pipes below. By an indication placed on the spindle the engineer can see whether the lubricator is in or out of action.

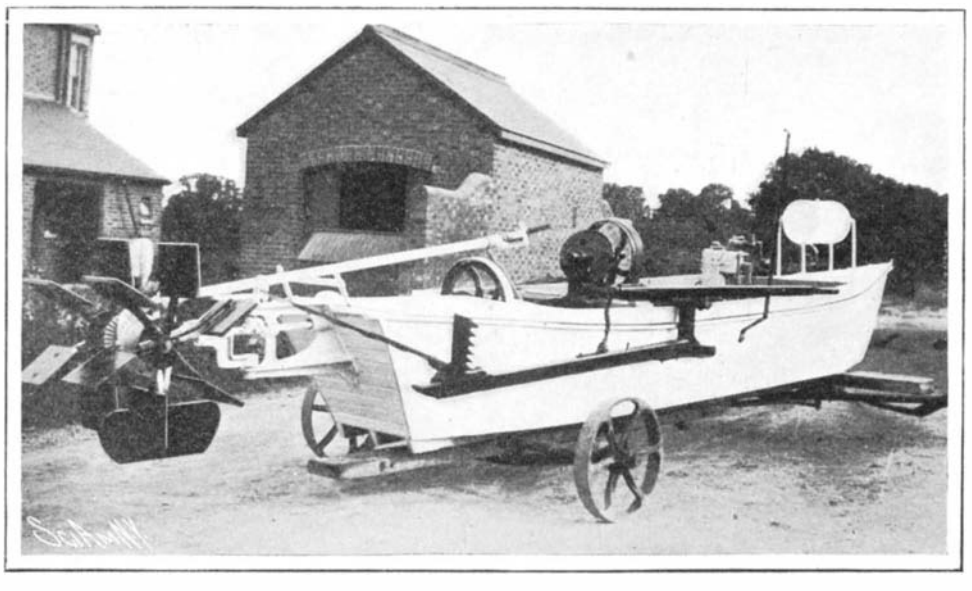
A NOVEL POWER LAUNCH FOR CLEARING WEED-INFESTED WATERWAYS.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

The problem of clearing rivers and other important waterways of weeds and various aquatic growths, which offer a serious menace to navigation, especially in tropical areas, is one of acute difficulty. Yet their removal is one of imperative necessity, since if unmolested they thrive and multiply to an alarming extent. This fact has been powerfully emphasized in Florida, where the rivers are practically overgrown with the water hyacinth. But experience gained by experiment has demonstrated that the only successful method of combating the growth of such pests is to cut them frequently, so that their vitality becomes impaired, and they gradually become exterminated. The plants must be cut just before they reach the surface of the water, and cut again and again throughout the season of growth, so that the leaves may never have the opportunity to breathe and then they will slowly weaken and finally succumb. But the difficulty and expense of cutting these aquatic growths by existing methods is so great that it has militated against this course of action.



The Weed-Cutting Launch Under Way.



The Launch on Dry Land, Showing Operative Mechanism.

THE SAUNDERSON GASOLINE POWER WEED-CUTTING LAUNCH.

A motor launch equipped with a novel cutting appliance for such operations, however, has been devised by an English firm, and has proved highly efficient in operation. This vessel when loaded draws less than 12 inches of water, rendering it convenient to handle and the most difficult and shallow places readily accessible. The propelling arrangement comprises an ingenious stern-wheel system, the main feature of which enables it to be turned in little more than its own length even when traveling at a fair speed. The stern wheel is held in position by a radial arm, hinged vertically on the stern end of the boat, so that the whole wheel may be directed like a rudder at any angle of the boat by a simple lever or by wheel steerage, and thus the power of the engine is applied to the turning of the boat. On account of this and the shallow draft, it forms an ideal craft for lakes and rivers in all tropical countries. These launches are built in various sizes. They are driven by gasoline or heavy oil motors ranging from 4 to 20 B. H. P., or steam motive power. They are built of selected timber in two thicknesses, ⅝-inch thick each, and are strong and durable. Above the waterline their appearance is much the same as an ordinary launch. When driven by steam power, the engines used are of the high-speed vertical type, fitted with link reversing motion and governors. The oil and petrol engines are of the vertical inclosed type, the reversing motion being obtained from the special gearing of the stern wheel. The cutting machinery is both ingenious and effective in its operation. However slimy and tangled the aquatic growth may be, the cutters do not clog, and cut the strongest growths with complete and equal facility. The cutting device consists of two spring-steel blades arranged in V form, having steel sections riveted to them, forming a scalloped cutting edge, very similar to the well-known Christie bread-cutting knife.

This machinery is fixed on a bedplate for operation, either by hand or mechanical power, and has also a hand weed hook or sickle for clearing small confined areas where the ordinary mechanism cannot be employed.

The blades are attached to a wood lever, 7 or 8 feet in length, and are oscillated by a simple cam movement, which is secured to a wood bedplate, carrying the entire apparatus, which may be attached to any kind of boat or punt. The cam shaft is driven by hand in case of the hand-power cutters, and by belt from the main shaft of the launch in the power cutters.

The launches and machinery are of varying cutting capacity, ranging from 2½ acres to 5 acres per hour. One of these novel appliances, built of steel and driven by steam, has recently been acquired by the Egyptian government. To prove its efficiency, the apparatus was submitted to a severe test. A large quantity of water weeds were first cut in the ordinary way, and were then collected as they floated on the surface of the water. They were then piled up in a stack on the water until there was a solid mass of weeds, on which several men could stand. This mass, two or three feet thick, resembled the sudd. The next step was to clear the mass, and this was done by hand weed-saws, and power weed-saws worked by the launch engine, which cut clean through the mass vertically and divided it into big blocks. These blocks were then towed away and allowed to float out to sea. The weed-saws are made on the same principle as the ordinary weed cutters, with scalloped cutting edge, but are worked vertically instead of horizontally.

Hydraulic Plants in Italy.

The use of water power for operating electric plants is constantly on the increase in Italy, especially in the northern part of the country. Not long ago two large hydraulic stations were set running. One of these is situated at Turbigo and has a capacity of 8,000 horse-power. It furnishes current for the region of Gallarate, Varese and Legnano. The other plant is at Zogno in the Brembana valley, and supplies a total of 8,500 horse-power. Besides the two plants which are now running, a third hydraulic station which will be erected at Trezzo d'Adda will distribute 8,500 horse-power to the region around Monza and Bergamo. Among other plants which are now building may be mentioned the hydraulic station which the Conti company are erecting in the neighborhood of Vigevano, which is a small industrial center to the southwest of Milan. It will have a capacity of 7,500 horse-power. When the last two plants have been completed, the Milan district will have as much as 60,000 horse-power in the different hydraulic stations. This development of water power is an important factor in the north Italian region and will contribute greatly to the growth of the industries, seeing that each horse-power furnished by the hydraulic plants represents an annual economy of $20 in imported coal, that is to say, a sum which would go to the benefit of England or America.

The directors of a certain continental gas company recently made a tour round Berlin to ascertain if there was left in the whole city a flat-flame gas burner. Their exploration failed to produce such a burner until they came to their own works, where one was found.

MODERN THERMOMETRIC APPARATUS FOR HIGH TEMPERATURES.

BY L. RAMAKERS.

Within comparatively recent years, the demand for apparatus for pyrometric measurement has increased rapidly. Wherever high temperatures are used in the production or treatment of manufactured products it is now more or less necessary to have complete knowledge of temperature conditions. Not only is this the case purely in the interest of theoretical science—in practice time is usually not available for this purpose—but it is true from an entirely practical standpoint. Often it is absolutely essential to know if the firing is being done economically, if the same effect can be produced with a lower temperature and a consequent saving of coal. Another consideration, particularly in iron and steel works, has led to the introduction of the recording pyrometer. For the proper control of a blast furnace it is of the utmost importance that the temperature of the hot blast, heated by a Cowper apparatus and forced into the furnace, shall not fall below a certain point. As a blast furnace is in operation continuously, day and night, it is of course impossible constantly to examine it. Consequently the continuous registration of the thermometric conditions places in the hands of the superintendent an invaluable means for correcting irregularities of more than momentary duration. For this particular purpose the pyrometer has come so generally into use that it is practically an absolute necessity, and there is probably no iron works of any size in which it is not used. The following is an account of a type of apparatus recently introduced by the Siemens & Halske Company, of Berlin. It may be said here, that the illustrations show the instruments exactly as they are in operation and in the condition in which they have repeatedly proven their usefulness.

PYROMETER FOR TEMPERING FURNACES.—Figs. 1 and 2 show the arrangement of a tempering furnace whose degree of heat is registered by means of two thermopiles or elements, and a galvanometer. The thermopiles are inclosed in the protective tube which projects from the top of the furnace (Fig. 1). They consist of two wires of platinum, or to be exact, of an alloy, 90 per cent platinum and 10 per cent rhodium, 0.5 millimeter in thickness. The connecting wires from the two elements run to a two-pole switch, by means of which either one or the other of the thermopiles can be thrown into circuit with the measuring and registering instrument. This is placed upon a small but solid bracket shelf on a nearby wall, as well protected as possible from vibrations and shocks. For purposes such as the above, pyrometers are of incalculable value. So high is the grade nowadays required in tool steel, that it is absolutely necessary that in this very process of tempering, the different kinds of steel receive, so to speak, individual treatment. It has been proven that the estimation of hardening temperatures by eye is too uncertain to allow of a uniform product. The readings of a pyrometer enable us to keep the temperature of a modern gas furnace constant to a degree, and by this means a uniformity in the quality of the different kinds of steel is attained which is of the greatest value in the manufacture of tools and which has hitherto been impossible.

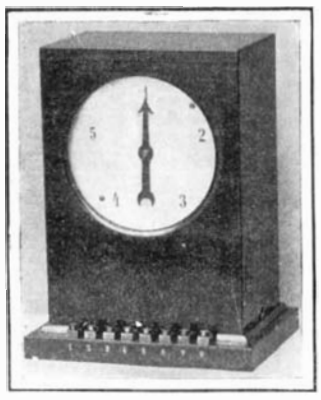


Fig. 5.—AUTOMATIC INDICATING SWITCH.

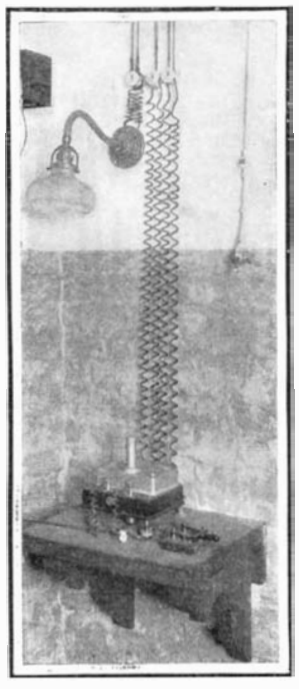


Fig. 2.—INDICATING GALVANOMETER.

PYROMETER FOR IRON WORKS.—Figs. 3 and 4 show the arrangement for temperature measurements in the hot blast conduit of a blast furnace. The purpose for which these instruments are installed is as follows: Every blast furnace includes two so-called Cowper apparatus which are in reverse operation at the same time. The hot waste gases from the furnace pass through the one, heating the brickwork passages, while a current of cold air is drawn into and forced through the other apparatus, which has been previously heated, by means of blowers. This current of cold air is thereby raised some 700 deg. to 900 deg. C. in temperature. When the temperature of the latter apparatus and of the blast passing through it has fallen a certain amount the process is reversed. That is, the cold air is drawn into the heated apparatus while the other is again reheated. In order to permit these proceedings to be closely watched a thermopile in a protective tube is inserted in the hot blast conduit which encircles each furnace. The conductors, carried on insulators, lead from the free ends of the thermopiles to the common location of all the registering mechanisms. Lightning arresters are included in the circuit to protect the instruments against atmospheric discharges or high tension external circuits.

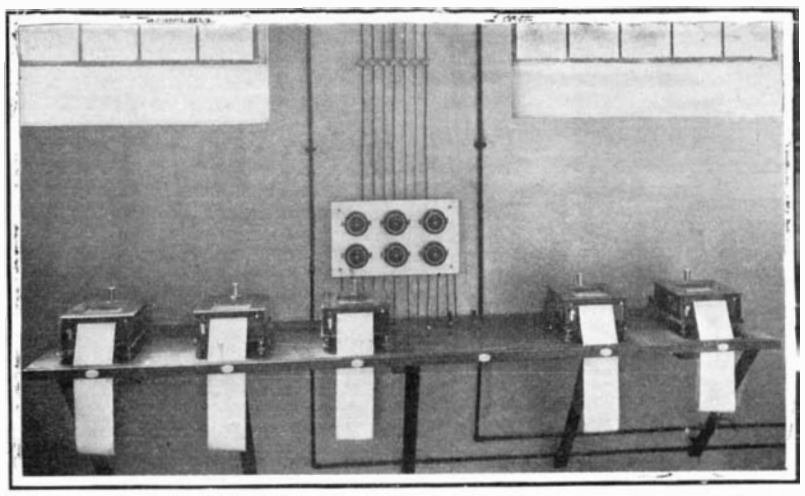


Fig. 4.—APPARATUS FOR RECORDING THE TEMPERATURE OF THE PRODUCTS OF COMBUSTION OF FIVE BLAST FURNACES.

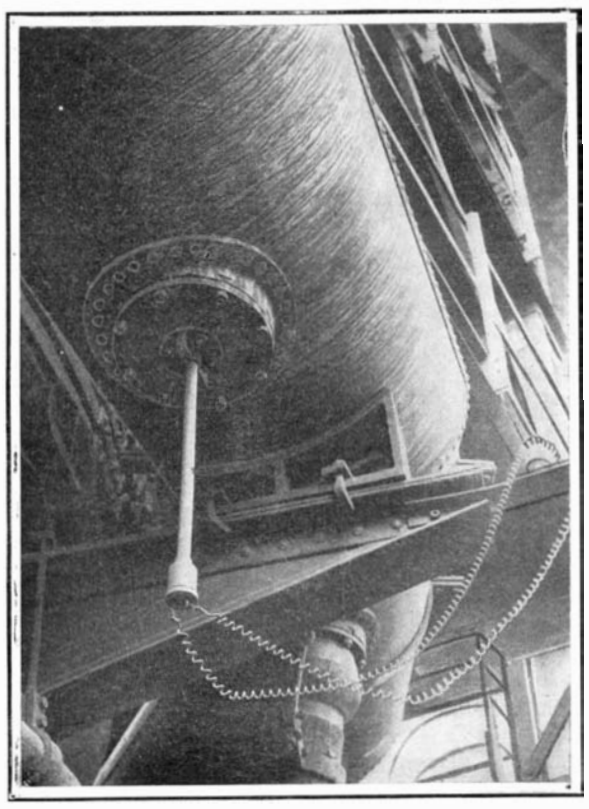


Fig. 3.—HOT-AIR CONDUIT OF A BLAST FURNACE WITH THERMO-ELEMENT.

It is very easy to keep a close watch on this arrangement and by means of it the running of each individual furnace can be followed from the above said central location. Every variation in temperature is at once recorded in the diagram, so that the superintending official is at once in a position to correct possible irregularities, which in an industry of this kind are otherwise very difficult to locate and to trace.

PROTECTIVE CASING.—At such places where an open installation of the instruments, which are, on the whole, rather delicate, is not advisable because of dust or injurious vapors in the air, it is best to inclose them in tight protective casings. Each of these casings contains besides the instrument itself, a roll for the recording paper which can be adjusted from the outside. Besides the slit for the paper strip, there is an opening closed by a lid, for winding or regulating the clockwork. Consequently it is necessary to open the case only when the roll of paper is to be renewed, that is, four times a year. Glass-covered openings in the top of the case afford means for taking readings.

The above sketched examples are but a few of the many ways in which these instruments may be utilized. Particular constructions make these methods of measurement applicable for many different purposes. For instance, their use enables us easily to regulate the steam temperature in superheating steam engines; or in other cases to ascertain the temperature of chimney or flue gases. Particularly useful are they in the latter instance in the investigations or tests of boilers.

In connection with Fig. 4 we may mention an apparatus whereby we are enabled to ascertain the temperature of several points with the use of only one registering instrument. In order to do this an automatic switch or cut-out (Fig. 5) is used by which a number of thermo-elements may alternately be placed in circuit with the registering instrument. This switch at the same time indicates which element and consequently which furnace is connected with the galvanometer.

Navigation on Lake Titicaca.

A second steamship is to be placed in service upon Lake Titicaca in Peru, the highest lake in the world, being some 15,000 feet above sea level. There is already one vessel engaged in traffic upon this sheet of water, the "Coya," the construction of which was described in the SCIENTIFIC AMERICAN some months ago. This latest vessel is named the "Inca," and will carry about 550 tons dead weight. It has ample arrangements and facilities for working cargo, and is provided with accommodation for 24 passengers. The dimensions are 220 feet in length, by 30 feet beam, and 14 feet depth. It is to be propelled by twin-screw engines developing 1,000 horse-power, and will have a speed of 12 knots. The vessel has been designed in England, and erected in the yard of Earle's Shipbuilding and Engineering Company, of Hull. The parts were carefully numbered during construction, then disassembled and dispatched to Mollendo, South America, the Pacific end of the railroad to Lake Titicaca, for disembarkation. The sections will then be transported to the shores of the lake, where the vessel will be re-erected and launched.

Electric fuses are of two distinct kinds, viz., high tension and low tension. In the low-tension system, which is gradually superseding the high, the fuse head consists of two insulated copper wires, joined by means of a thin platinum bridge, which, owing to its higher resistance to the electric current, becomes incandescent when the current passes. This bridge is inserted in a capsule containing an explosive mixture, and the whole is hermetically sealed inside a detonator before being issued from the works. The fuse is fired in the ordinary way by a magneto exploder.

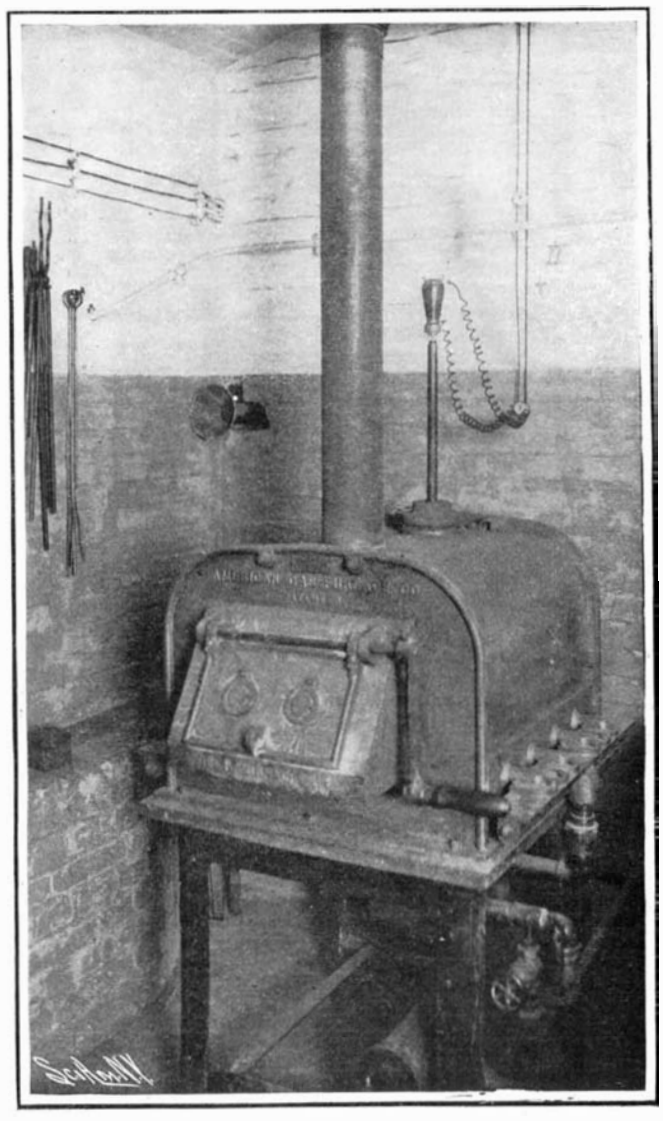


Fig. 1.—MUFFLE THERMO-ELEMENT.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

INSULATOR.—L. STEINBERGER, New York, N. Y. Mr. Steinberger's invention relates to useful improvements for electric conductors and also for deadening sound-vibrations in electric wires for telegraphs, telephones, and all other appliances where wires or other conductors require insulation from their supports. His more particular objects are to produce a highly-efficient and simple form of insulator in which the insulating quality is very great and in which the arcing distance between the wire and supporting pin is developed to its utmost limits, thereby affording an increased surface for preventing surface leakage and to prevent arcing.

BINDING-POST.—L. STEINBERGER, New York, N. Y. The invention admits of general use, but is of peculiar value, where it is desired that the post be imbedded in a mass of material—such, for instance, as hard rubber, celluloid, electrose, or the like—so as to be permanently secured therein. The object is to produce a useful device adapted for service in a great variety of places and to provide a mode of attachment which while forming a perfect electrical contact between the conductors shall also mechanically clamp or bind them together securely without diminishing their tensile strength and admit of either one of the wires being attached or removed without disturbing the remaining wire.

ELECTRICAL INDICATOR-SIGNAL.—G. W. PETTY, Alexandria, Va. This improvement is in the nature of a signal of the visual type designed to be set by electro-magnetical devices and comprehending a semaphore arm and lamp. Applicable in most of its features for general use, it is more especially designed for use in city streets and is combined with a fire-engine house and the stall-door for the horses and is arranged to give conspicuous visual indication on the street that the engine is about to issue from the house. The object is to avoid dangerous collisions between fire-engines and street-cars or vehicles when the engine is issuing from the engine house.

ARC-ELECTRODE.—D. A. HOLMES, S. A. TUCKER, and E. VAN WAGENEN, New York, N. Y. The invention refers to electrodes used more particularly for arc-lighting; and it consists of a composition of matter from which the arc-electrodes are formed. The composition used for the purpose of forming the electrode contains zirconium carbid, mixed with any desired percentage of a building material, such as coal-tar, lamp-black, molasses, etc.

Of Interest to Farmers.

SELF-MEASURING MACHINE.—W. BROUGH, Baltimore, Md. The object of this invention is to provide an automatic machine for measuring seeds or granular material and delivering the same to bags or other receptacles. The inventor has aimed at compactness, durability, simplicity, and economy of construction and also at convenience of adjustment of certain parts for varying the quantity or charge of seeds or other material measured and delivered at a given time.

SALT-DISTRIBUTER.—A. J. HAUS and A. W. LAABS, Lawler, Iowa. This invention has reference to improvements in devices for distributing salt to fodder or the like discharged from a threshing-machine or shredder, the object being the provision of a distributer that will work equally well with dry salt and damp or lumpy salt.

Of General Interest.

BACK-BAND BUCKLE.—W. R. MEDEARIS, Nashville, Tenn. The invention relates to an improvement in that class of buckles in which a front or face plate slides on a rear or base plate to form a closure for the hook which carries the trace-chain. The aim is to provide a combined back-band buckle and trace-carrier which shall be easily manipulated, and which can be made from a very small amount of material.

BILLIARD-CUE.—C. S. JONES, Indianapolis, Ind. The invention is an improvement in cues, and has for an object to provide a novel construction including a cue-stick and means whereby the same may be operated pneumatically or by air-pressure. By its use the game of pool or billiards may be played upon a smaller table, and a large room will not be required, as in the present method where longer cue-sticks are used. Smaller tables may be arranged in close proximity without players at one interfering with players at adjacent tables. The inventor claims the pneumatic cue will reduce games to a more scientific basis.

STUFFING-BOX.—H. L. NOXON, Bakersfield, Cal. The box is particularly adapted for use in connection with oil-wells in districts in which much sand is ejected with the oil. In these wells it is customary to use a flexible pump-rod, bringing pressure upon the latter. This, with abrasive action of the sand, produces an extremely destructive effect upon the boxes and, as they are customarily of some such hard metal as iron, upon the rods as well, rendering it necessary to often discard both and put in entirely new ones. The invention obviates these difficulties.

METHOD OF SEWING SHOE-SOLES TO UPPERS.—J. A. RHOULT, Haverhill, Mass. The object of the invention is to provide a method for sewing soles of leather shoes, boots, and similar footwear to the uppers thereof by machinery in a very simple and economical manner without requiring the use of lasts for forming the uppers and allowing the uppers and soles to be sewed together without turning the uppers and without the use of insoles, thereby avoiding straining, cracking, or tearing of the uppers, doing away with insoles, making the shoes more flexible, and materially lessening the weight of the shoe.

BUILDING CONSTRUCTION.—O. PRICE, Plainfield, N. J. In this instance the invention has reference to an improved building-block formed of a composite of concrete or equivalent plastic material and a strengthening metallic frame and to a peculiar manner of constructing these blocks into a building to produce an imitation-stone and other advantageous effects.

NOODLE CUTTER.—W. V. HEINZ, Lasalle, Ill. In this patent the invention relates to a device for cutting dough into strips, such as noodles. The object of the improvement is to provide a device that will cut a parallel series of strips out of a flat piece of dough and at proper intervals will sever the strips for the purpose of making them of uniform length.

INK-HOLDER.—L. EDELMUTH and R. NAUMANN, New York, N. Y. The invention relates particularly to improvements in devices for holding inks, the object being to provide a holder of novel construction, so arranged as to protect the ink from dirt and air, thus preserving the ink in good condition, and further to provide a structure that will facilitate the handling of inks substantially without loss or waste.

SELF-CLEANING FILTER—O. L. BESSEBERG, Hönefoss, Norway. This invention refers to filters employed for filtering water from a river or other waterway, the filtered water being intended for use in towns, dwellings, paper-pulp and other factories. The object is to provide a filter very effective in operation, self-cleaning, and arranged to furnish a constant supply of filtered water and requiring little, if any, attention.

FIRE-ESCAPE.—H. C. WHITLEY, Emporia, Kan. In this patent the invention is an improvement in fire-escapes, and particularly in that class of such escapes known as "frictional," in which the device supporting the escaping person is movable along a rope and friction is utilized to retard the descent of the escaping person.

DUMB-BELL.—C. E. HAM, Boston, Mass. This bell belongs to the "spring" dumb-bell class, which usually comprise oppositely-disposed bars maintained apart by springs. These heads present angular corners, which are a defective feature, offering opportunity for abrading the skin. The inventor overcomes these defects and provides a bell, the body of which presents a resilient resistance to compression. The invention consists in the construction and relation of opposing parts, and concerns itself also with improvements relating to means for guiding them upon each other and for mounting the spring to thrust them apart.

Heating and Lighting.

VAPOR-LAMP.—J. SPIEL, No. 85 Turmstrasse, Berlin, Germany. The chief object in this instance is the production of a more intense generation of vapor, which the inventor effects by constructing and arranging a vapor-generating device (a vaporizer), and the starting or heating-up device in such a manner that the entire heat of the lamp-flame, as well as the heat of the heating-up device, is conducted to a small portion of the vaporizer, which is thereby raised to a bright red heat, so that an efficient generation of vapor is insured, while choking of the vaporizer-nozzle due to partial condensation of fuel is prevented.

Household Utilities.

EXTENSIBLE BEDSTEAD.—W. A. H. JONES, Plymouth, Mass. It is the purpose in this case to provide a connection between the movable and fixed bed-sections consisting of members so disposed that the movable section will be lifted from its position when open or alongside the fixed section and thereupon placed upon the fixed section. Suitable springs are provided in connection with said members, so as to assist the movement of movable section during portion of its movement when it is raised and to offer a certain resistance to the movement when the movable section is being lowered from its highest intermediate position—that is whether the bed is being opened or closed.

Machines and Mechanical Devices.

INTERMITTENT CLUTCH DEVICE FOR TYPE-CASTING AND TYPE-COMPOSING MACHINES.—M. WEHRLIN, 74 Rue de la Victoire, Paris, France. This invention allows of the rocking movements of the yoke being produced exclusively during the period of preparation for the justification before the beginning of each line and of keeping the yoke at rest the remaining time. This arrangement is of very great importance, even with short lines. For instance, with lines containing fifty characters the yoke instead of remaining in motion, as in the English patent No. 18,542, during casting of the type and then during the justification and the carriage of the line, will only operate during justification—that is to say, instead of making fifty-three complete movements it will only make two.

DISTILLING APPARATUS.—W. B. HARPER, Lake Charles, La. The object of the invention is to provide an apparatus, more especially designed for the manufacture of turpentine, acetic acid, wood alcohol, tar, charcoal, wood-pulp, etc., by the destructive distillation of wood, coal, or other organic or inorganic matter containing any or all these products, the apparatus being durable in construction and arranged to readily separate the volatile matter and oils from the wood and solid matters or fibers from the tar.

AUTOMATIC TENSION DEVICE FOR YARN-WINDING MACHINES.—H. B. BECKMAN, Newburgh, N. Y. The invention pertains to means whereby cord may be wound simultaneously with coarse or fine yarn on a warp-beam which is to be used subsequently in a loom for weaving corded fabrics, whereby a single beam wound as contemplated by this inventor may be used with the same effect in weaving corded fabrics as when yarn and cord are beamed upon separate beams. The prime object is to provide means entirely automatic in its action for winding cord-strands uniformly with yarn of either coarse or fine nature on warp-beams.

INDEPENDENT PORTABLE PROPELLING MECHANISM FOR SEWING MACHINES.—H. MANNING, 1a Foster Lane, London, England. In the present patent the invention consists of separate portable treadle-operated driving-gear especially suitable for use in connection with sewing machines, and is adapted to be held steady by the foot of the operator or to be removably attached to any ordinary table to which the sewing mechanism proper is fixed.

Prime Movers and Their Accessories.

SOLAR MOTOR.—E. P. BROWN, Cottonwood Falls, Kan. In carrying out this invention Mr. Brown had particularly in view the provision of an apparatus including a reflector and a boiler, whereby the rays of the sun may be focused by the reflector upon the boiler to generate steam. Of several objects, another is to provide a reflector designed to turn upon one axis, so as to at all times face or follow the sun in its diurnal movement, said reflector being also capable of moving upon a vertical axis, so as to conform to the annual variations or movements of the sun.

HYDRAULIC AIR-COMPRESSOR.—W. G. COX, New York, N. Y. One purpose of the invention is to improve upon the hydraulic air-compressor for which Letters Patent were formerly granted to Mr. Cox, to such an extent that the mechanism is simplified and two floats instead of but one are employed, one of the floats being connected with the lever-arm controlling the outlet and inlet valves for the water.

STEAM-ENGINE.—J. A. TOOLEY, Stamford, N. Y. To provide a steam-engine of the compound type arranged to utilize the steam in the high-pressure cylinder approximately under boiler-pressure to insure a quick passage of the exhaust-steam from the high-pressure cylinder to the low-pressure cylinder and to utilize the steam in both cylinders to the fullest advantage, is the object of this invention.

ROTARY CARBURETER.—D. B. YOUNG, Culver, Ind. The principal object of this inventor is to provide a carbureter which may be applied to the intake-pipe of a gasolene-engine and which will be operated by the passage of the mixture of the air and gas therethrough to effect perfect and homogeneous mixing of the air and hydrocarbon vapor which form the ingredients of the explosive mixture to be ignited in the cylinder of the engine.

ROTARY ENGINE.—S. S. SADORUS, Sarilda, Idaho. Steam delivered at the feed-ports will operate between adjacent casing abutments and the piston-blades in advance thereof and drive the piston, a track operating upon crank-arms of the pistons to hold the same across the steam-space until the piston reaches the exhaust-port, when the cut-away portion of the track permits the piston-head to tilt, so steam or the like will not be compressed between the same and the abutment which it approaches, and the blade may also be seated in its recess as it passes such abutment and will again be brought to position to receive the impact of steam admitted at the lower feed-port, and the operation will proceed as before.

Pertaining to Vehicles.

AUTOMOBILE.—B. E. HERVEY, Spokane, Wash. For propelling the vehicle four push-rods are employed, which are hinged to the cranks of a crank-shaft, having bearings in brackets attached to the under side of the vehicle-body. Rotation is imparted to the crank-shaft from a counter-shaft, the latter arranged above the bottom of the vehicle and connected with the crank-shaft by sprockets and chains. A motor is employed to drive the counter-shaft. Means are provided for raising the push-rods out of engagement with the ground or roadway to back the vehicle.

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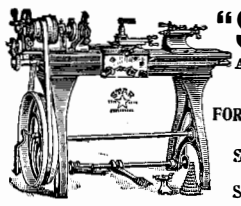

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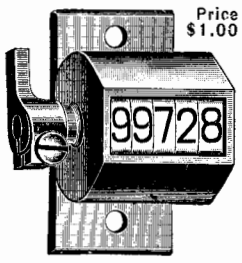

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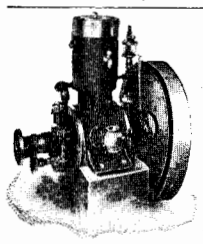

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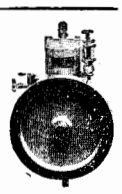

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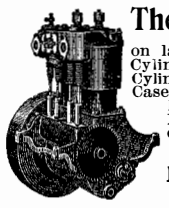

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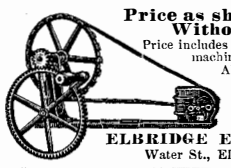

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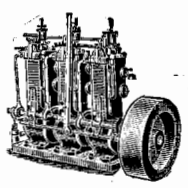

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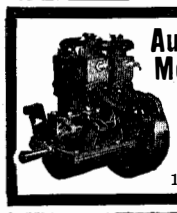

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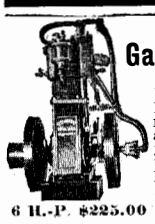

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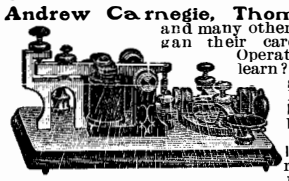

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HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(9640) W. G. says: I have for some time been trying to find out if kerosene oil engines, marine type, will work satisfactorily when installed in a boat and handled by a novice. No one to whom I have applied, except the manufacturers, seems able to state whether they will or not; while some gasoline engine builders ridicule them, so the only solution that occurred to me was to write to you. A. Kerosene oil engines are more difficult to successfully operate under all conditions than gasoline engines, and in the hands of inexperienced persons give more trouble, we believe; but, on the other hand, they are much less expensive to run. We think you would be safer with the gasoline engine, but we know of instances where such kerosene engines as you mention have given most satisfactory service.

(9641) M. L. S. says: Would like to know how to repair tortoise shell where it is broken. A. 1. Bring the edges of the pieces of shell to fit each other, observing to give the same inclination of grain to each; then secure them in a piece of paper, and place them between hot iron or pincers; apply pressure, and let them cool. The heat must not be so great as to burn the shell; therefore try it first on a white piece of paper. 2. Small pieces of good tortoise shell may be joined so as to form one large apparently seamless piece in the following manner: Slope off the margins of the shells for a distance of about one-quarter of an inch from the edge. Then place them so that the margins overlap one another; and thus arranged put them in an iron press and immerse in boiling water for some time. The pieces by this means become so perfectly united that the joint cannot be seen. The filings and very small scraps may be often softened in hot water and consolidated by hydraulic pressure in metal molds. Protracted pressing of tortoise shell darkens it, and greatly lessens its beauty.

(9642) F. says: In latitude 40 deg., when it is exactly ten hours from sunrise to sunset, a ship starting at sunrise, and pointed always toward the sun, travels ten miles an hour. What sort of a curve will she have described, and how far, at sunset, will she be, in a straight line, from her starting point? In consequence of the absence of centrifugal force, is not an object at the poles appreciably heavier than it would be at the equator? A. A body is 1-289 part heavier at the poles, by reason of the absence of centrifugal force at the poles. Any good textbook of higher physics will give you the demonstration of this fact. Your curious inquiry about sailing a vessel pointing all the time toward the sun is entirely impracticable. Why should any one want to sail a ship in that way? The exact theoretical solution involves the calculus, giving an equation which can only be solved with great difficulty. We cannot spend time for such purposes. Practically, the solution is the same as if the earth were a plane, flat, and so large that the ship would nearly follow the arc of a circle during the day. The days when the sun is above the horizon ten hours in latitude 40 deg. are a few days on each side of the winter solstice. It rises nearly 60 deg. east of south. The place of sunrise is calculated by spherical trigonometry, to which we would refer you. Your ship would make a harmonic curve from morning to noon, which could hardly be distinguished from an arc of a circle on a plane of the earth's surface, and from noon to sunset the curve would be turned to the west, reversing its morning half. As we said above, we do not care to work out so useless a problem. It can benefit no one, nor add to the world's stock of useful knowledge. Some mathematical society or mathematical journal which delights in pure mathematics may be glad to solve it for you, if you do not succeed in solving it for yourself.

(9643) S. C. B. asks: Why is it that a gravity battery will not run a battery motor? Will a Daniell cell run a battery motor? A. A gravity battery of a sufficient number of cells will run a motor, so also will a Daniell's battery. A single cell of either will run a motor which only requires one cell. One horse will draw a certain carriage. Two will be required for a larger carriage. Forty may be re-

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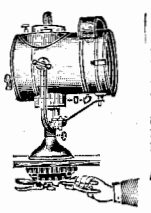

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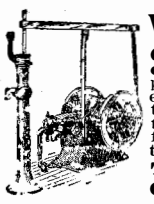

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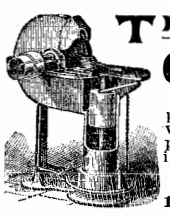

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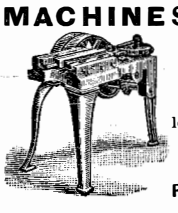

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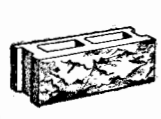

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MARINE ENGINES AND BOILERS. THEIR DESIGN AND CONSTRUCTION. By Dr. G. Bauer and Leslie S. Robertson. New York: The Norman W. Henley Publishing Company, 1905. Medium 8vo., pp. 772; 550 illustrations; numerous tables. Price, $9 net.

This valuable work is a translation of the original book compiled by Dr. G. Bauer, the Engineer-in-Chief of the Vulcan Works, Stettin. It was translated from the second German edition by E. M. Donkin and S. Bryan Donkin, associate members of the Institute of Civil Engineers, and is edited by Leslie S. Robertson, member of the Institute of Civil Engineers and secretary to the Engineering Standards Committee. The fact that the original German work was written by the chief engineer of the famous Vulcan Works, Stettin, is in itself a guarantee that this book is in all respects thoroughly up-to-date, and that it embodies all the information which is necessary for the design and construction of the highest types of marine engines and boilers. It may be said without fear of contradiction, that the motive power which Dr. Bauer has placed in the fast German liners that have been turned out of late years from the Stettin Works, represents the very best practice in marine engineering of the present day. German textbooks have a well-earned reputation. They are clearly written; thoroughly systematic; theoretically sound; and they all have a characteristic breadth, thoroughness, and detail; while the character of their plans, drawings, tables, and statistics is almost invariably above reproach. The present work embodies, in a marked form, all of these characteristics. The illustrations are careful reproductions from actual working drawings, with some well-executed photographic views of completed engines and boilers. Among the latter we note the engines of the Japanese armored cruiser "Yakumo," the quadruple-expansion engines of the "Deutschland," and of the "Kaiser Wilhelm II.," and many other specimens of high-class marine work. Part I. is devoted to Main Engines, and in Section V. of this part, relating to details of main engines, there are no less than 178 illustrations. Part II. is devoted to pumps; Part III. to shafting, resistance of ships, and propellers, in Section III. of which, devoted to the screw propeller, there are 35 illustrations; Part IV. treats exhaustively of pipes and their connections; Part V. of steam boilers; Part VI. of measuring instruments; Part VII. is devoted to various details; and Part VIII. contains a very complete arrangement of various tables. Among the many text-books that come to the Editor's desk for review, we have rarely seen one that calls for such unqualified commendation as this.

OFFICIAL CATALOGUE OF THE EXHIBITION OF THE GERMAN EMPIRE AT THE INTERNATIONAL EXPOSITION, ST. LOUIS, 1904. Edited by the Imperial Commissioner. Berlin: George Stilke. 8vo.; pp. 538.

This handsome volume is at once a characteristic memento of the St. Louis Exposition and a forcible object lesson on the æsthetic side of the printer's art. Incidentally, in its embellishments, it calls to mind that "new art," which received such striking illustration throughout the whole of the German exposition at St. Louis. The letterpress throughout is strikingly bold and wonderfully harmonious, and on every page of it there is evidence of the most careful consideration of the composition. The work is no mere bald catalogue of exhibits; for under each department there is given an amount of information as to the history and practice of each art that renders this work almost a cyclopedia of the modern German industries.

PLANK-FRAME BARN CONSTRUCTION. By John L. Shawver. New York: David Williams Company, 1904. 12mo.; pp. 35. Price, 50 cents.

This book is the compilation of articles that appeared in "Carpentry and Building." Its author has had a great deal of experience in the construction of plank-frame barns—barns which have been growing in popularity in various sections of the country, particularly in the West. In the present small volume he points out the advantages of this form of barn construction, and shows that a saving of time, labor, and material may be had by employing it.

THE AUTOMOBILE HANDBOOK. By L. Elliott Brookes. Chicago: Frederick J. Drake & Co., 1905. 16mo.; pp. 320. Price, $1.50.

This is one of the most practical handbooks for the motor-car user which we have yet seen. The subjects described are arranged in alphabetical order, and are very concise. Information concerning all types of automobiles is contained in its pages, and this information is supplemented with very good line drawings of a simple character. The book also contains a considerable number of useful tables, and formulas for calculating horse-power and for making brake tests of motors are included in the book. The work will be found a very handy pocket volume by every automobilist.

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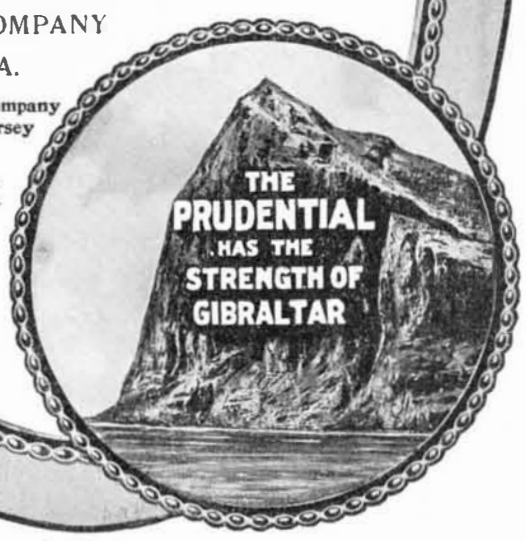

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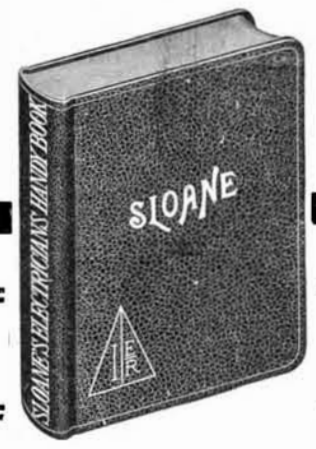

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TYPE STUDIES FROM UNITED STATES GEOGRAPHY. By Charles A. McMurray, Ph.D. New York: The Macmillan Company, 1904. 8vo.; pp. 288; 99 illustrations. Price, 50 cents.

This book contains a series of simple type studies of the United States, intended to introduce children to the geography of our country. The book can be used as auxiliary to the regular textbook, in the fourth, fifth, and sixth grades. It describes various interesting geographical and engineering features of the United States, such as the large rivers, the highest mountains, the great lakes, the prairies, the pine forests and lumbering, coal mines, irrigation, salmon fisheries, etc.; and all these descriptions are photographically illustrated.

THE TIMBERS OF COMMERCE AND THEIR IDENTIFICATION. By Herbert Stone, F.L.S., F.R.C.I. London: William Rider & Sons, Ltd., 1904. 8vo.; pp. 311; 186 photo-micrographs. Price, $3.

This book describes briefly all the commercial timbers met with in England and her colonies, as well as a few others which are likely to be heard of in the future. All the genera mentioned are illustrated by photomicrographs, showing a cross section three times the actual size, or as it would be seen by an ordinary hand magnifying glass. In some cases a single illustration serves for more than one genus; but wherever two or more distinct types of the same genus are described, separate illustrations have been provided, and the specific name is then quoted. Wherever possible, the photographs have been so taken that the medullary rays run in the same direction, the pith side downward. The photographs are actual silver prints from the negatives, and hence are much sharper and display considerably more detail than were they reproduced from half-tone cuts. The book should be very useful to all who have to do with woods for any purpose.

AUSTRALIAN MINING AND METALLURGY. By Donald Clark, B.C.E. Melbourne: Critchley Parker, 1904. 8vo.; pp. 620. Price, $8.50.

This book is the first exhaustive work on the subject to be published in Australia. The information contained in it is thoroughly up-to-date and reliable. All the great Australian mines are dealt with in detail, besides being fully descriptive of geological conformation, general resources, the methods employed in mining, and the metallurgical process adopted in treatment and extraction. The text embraces a critical examination and commentary upon working detail and means to ends, which cannot fail to be highly instructive to the most advanced mining men, and of special value to students. The work is divided into sections according to the different States, and western Australia, because of its importance, is described with great detail; but the mines of Tasmania, Queensland, Victoria, and New South Wales are also discussed very thoroughly. The book is illustrated with numerous photographs and drawings.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending May 16, 1905

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

Acetylene generator, F. Holly	789,856
Acid, making dialkyl barbituric, M. Engelmann	789,902
Acids, making C-C-dialkylbarbituric, E. Preiswerk	790,263
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Advertising coat and hat rack, W. J. Cooper	790,190
Air brake automatic setter, W. H. Brooks	790,102
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Amalgamator, J. J. Peacock	790,000
Amusement apparatus, A. F. Turpin	789,946
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Bearing for axle journals, lubricating, Monroe & Hallinan	790,220
Bed and couch, combination, C. L. Fenner	789,903
Bed corner fastening, J. Nelson	789,869
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Bed spring, adjustable, Hinrichs & Chada	789,728
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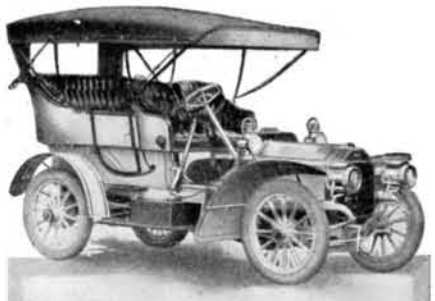

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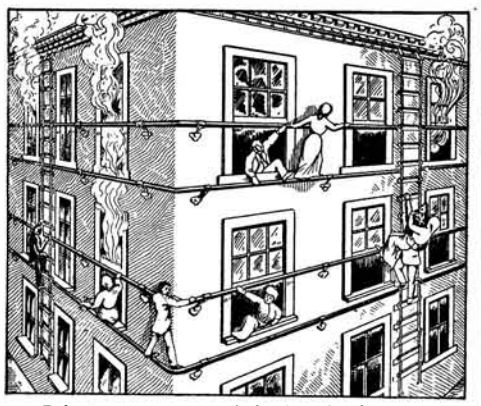

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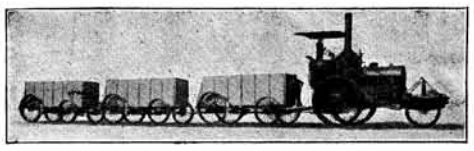

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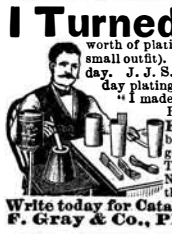

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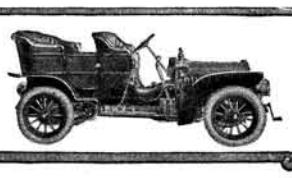

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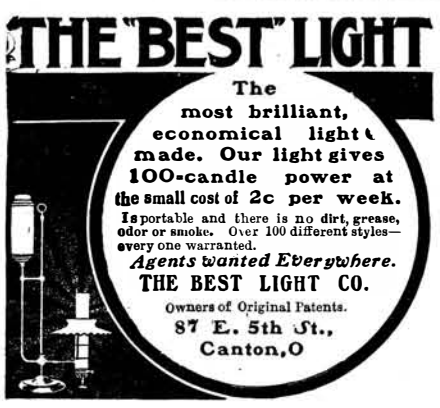

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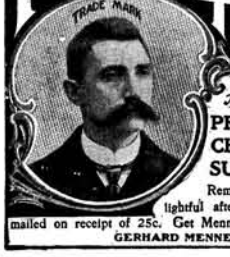

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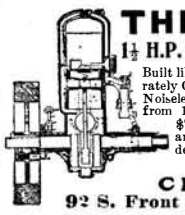

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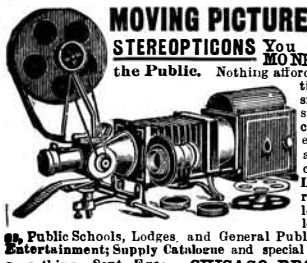

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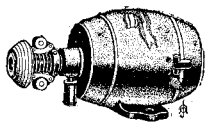

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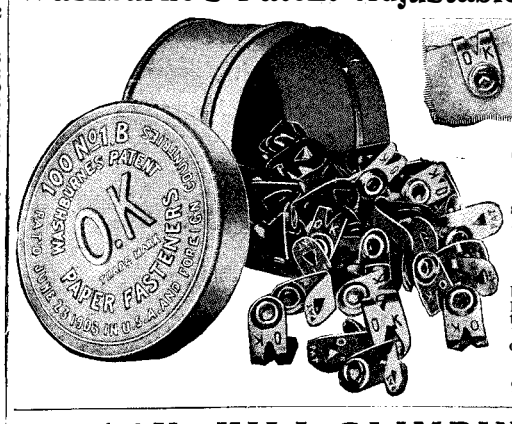

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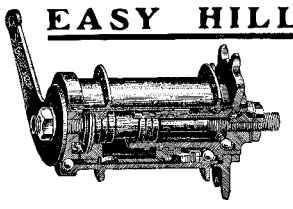

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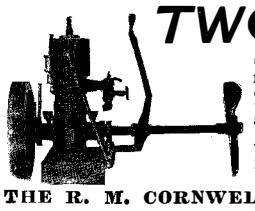

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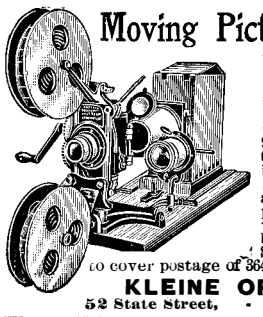

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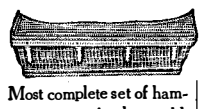

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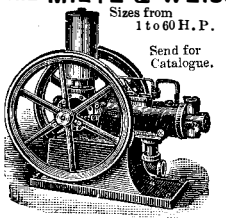

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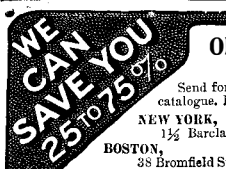

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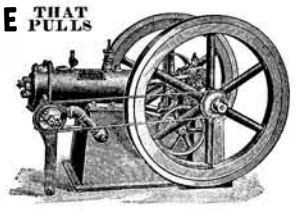

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THIS new monthly magazine will be much broader in scope than its prodecessor. It will have the word "Home" for its keynote. The one to whom this word has no meaning will have no interest in this new publication. It is the intention of the Editor to take the reader with him to various parts of the country, and show him how the better class of people live, whether the house may have cost $3,000 or $300,000. Good taste is, perhaps, more necessary in the building and furnishing of a house of small cost than in a mansion of importance.

The Editor will not leave you on the outer doorstep, however, but will take you within, where you may see how the house is furnished and decorated and how the owners live. Then you may have a walk through the garden, and then to the summer house, where, perhaps, the plan of the formal garden culminates.

There will be published articles on room decoration and furnishing, showing how the furniture may be arranged to produce the best effects, what pictures may be hung, and what bric-a-brac, inherited from some former mansion may with advantage be discarded. In short, the new publication is intended to be

OF INTEREST

to the one who has a Home. To the one who has not a Home, but intends to have one. To the one who wishes to improve his Home and make it more attractive. To the one who appreciates that the Garden and the House should form part of an harmonious scheme.

Each issue will contain an article on some important mansion, showing, if possible, various views of the exterior, the interior, and the garden. Plans are published with most of the residences shown.

The new publication will be issued monthly, and will be somewhat smaller in page size than the "Building Monthly," viz.: 10½ x 14. It will have a handsome colored cover. It will have about 50 pages each issue. Price, 25 cents each issue; $3 a year.

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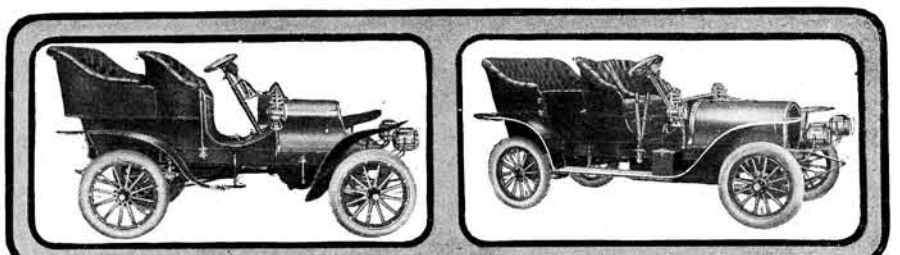

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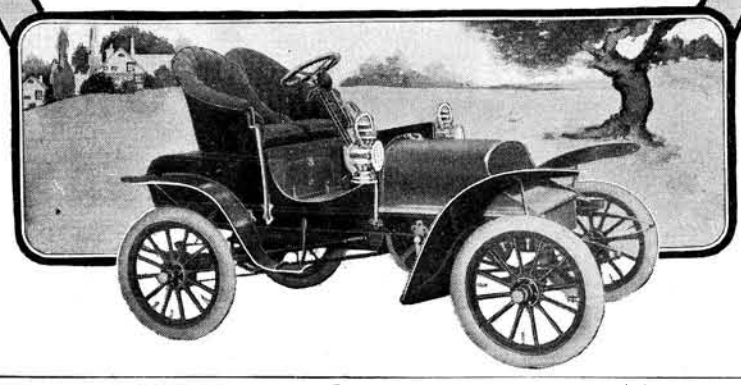

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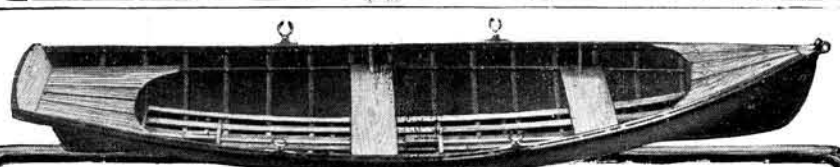

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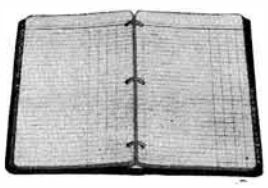

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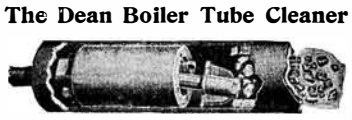

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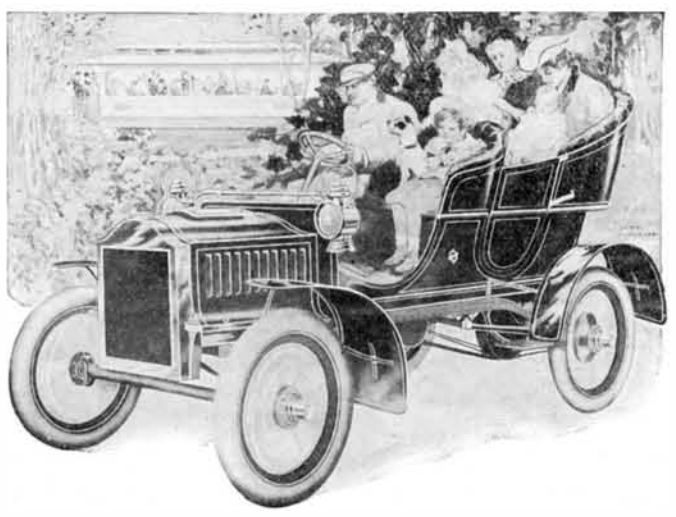

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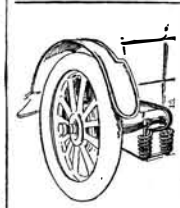

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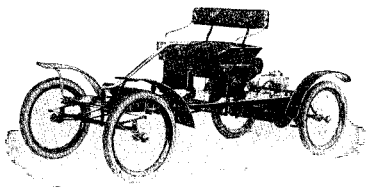

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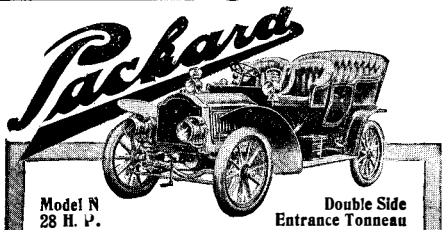

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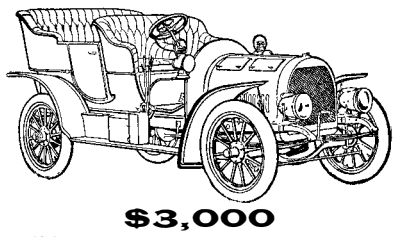

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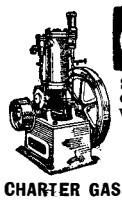

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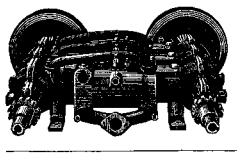

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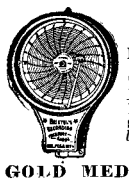

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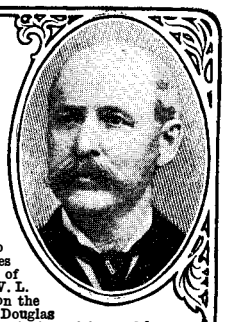

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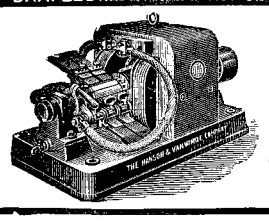

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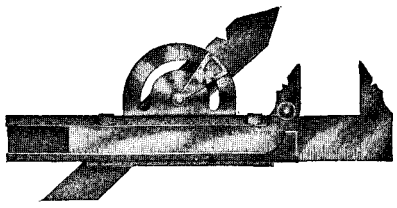

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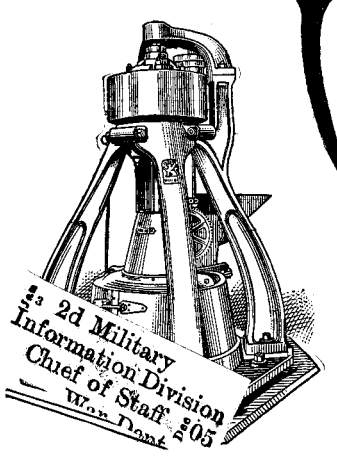

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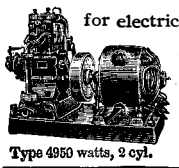

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